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EDITED BY

J. M'FADYEAN, M.B., B.Sc. F.R.S.E.
ROYAL VETERINARY COLLEGE, LONDON

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TOXICOLOGICAL EFFECTS OF CREOLIN IN THE DOG AND CAT.

By F. HOBDAY, Professor of Therapeutics, Royal Veterinary College, London.

THE growing popularity of creolin for use in both veterinary and medical practice, and the fact that it seems to be generally regarded as an absolutely innocuous compound, may make a few notes on its toxic properties and the care with which it should really be used of some value, particularly as it is so well known in England in the form of Jeyes' Fluid.

On turning to our text-books I find that Mr Finlay Dun, in his "Veterinary Medicines," says that creolin is non-irritant and non-poisonous, and that the in-rubbing even of concentrated solutions is readily borne.

M. Kaufmann, in his "Traité de Thérapeutique et de Matière Médicale Vétérinaires," second edition, says, when speaking of creolin, that "after its absorption it is absolutely harmless and never produces toxic symptoms," also that "as an antiparasiticide creolin is efficacious against mange of animals, and that without exposing them to risks of poisoning such as happen when using arsenic or preparations of tobacco;" and lastly refers to M. Nocard, whom he quotes as saying that creolin is not poisonous.

M. Cagny, in his work entitled "Précis de Thérapeutique Vétérinaire," says that creolin is non-poisonous, and that one invaluaole advantage (according to Professor Heydenrich of Nancy), is that it does not possess toxic properties, and consequently can be employed without

any fear and without limiting the quantity applied even to a sick person.

Trusting to the above statements, I used creolin in the treatment of disease without any fear of danger, until certain symptoms occurred which made me cautious and suspicious of its toxic effects. The first few cases which caused me to follow up the subject were as follows:—

A class C student had a couple of valuable ferrets severely affected with lice and mange, and, by my advice, he dressed them thoroughly with Jeyes' Fluid and water; the amount used was not accurately measured, but was roughly estimated at about 2 ounces to a quart of water; half-an-hour later they were both dead.

The second case was that of two toy Manchester terriers (weighing respectively about 6 and 7 lbs.) severely affected with sarcoptic mange. Ointments of creolin in lard were applied at stated intervals for rather more than a month, the animals becoming quite fat and so much improved that the owner was informed that one more thorough application would be sufficient to complete the treatment. To my surprise one morning I was informed that one animal was dead, the owner stating that it had become very listless, staggered about, becoming paralysed and completely prostrate before death. The other animal presented the same symptoms, and, in spite of all attentions, died.

The next case set all doubts at rest as to the toxic properties of creolin; the animal was a valuable bull terrier severely affected with follicular mange. As I had been for some time testing the value of various remedies in this troublesome disease, and had observed beneficial effects from periodical creolin baths, I determined to attempt a cure with a concentrated solution, and dressed the animal as mentioned below (Case 1). The result was most alarming, and all attempts to save the animal failed.

CASE 1.—12th October 1895. Bull bitch, about eighteen months old, suffering from demodectic mange.

10.10 A.M. Applied thoroughly with friction for fifteen minutes a solution of creolin (Whalley's) in water, the application consisting of 4 ounces of creolin mixed with 4 ounces of water.

10.30. The animal showed signs of very great irritation.

10.45. Bitch lying prostrate, semi-comatose, clonic convulsions of head and limbs, those of lower jaw being especially well marked. Thin frothy mucus around lips and in the mouth. Stertorous breathing (partly accounted for by shape of the dog's nose). Pulse quite impercepitible at femoral artery. Temperature could not be registered, apparently about 93°.

11.30. Comatose. Respirations short and quick, about 68. Temperature and other symptoms as at 10.45.

11.35. Placed in a hot bath and thoroughly washed the skin.

12.30 P.M. Respirations 50. Convulsions seemed to be rather more violent. Frothy mucus around the lips and in the mouth. Still comatose.

2.15. Temperature still about 93°, pulse 180, respirations 49. Convulsions of limbs were still present, but those of the lower jaw had ceased, and there was no frothy mucus around the lips. Consciousness appeared to be returning, the cornea now being sensitive to the touch.

3.30. Temperature 96°, respirations 46. Animal had regained consciousness and was walking about. Convulsions had almost ceased. Excessive thirst was present, the dog continually drinking water. Skin very dry.

6.0. Animal standing up and apparently well on the way to recovery.

10.45. Temperature 100·8°. Animal bright and lively.

13th October, 11.0 A.M. Slight dulness, otherwise all right; ate some food.

14th October, 10.0. Very dull; skin dry and darker in colour than normal; surface of body very cold. Drank water but refused food.

Administered a drachm of spts. ether. nit. with the same quantity of liq. ammon. acetat. every four hours, and placed her, well wrapped up, in a warm place, but she gradually relapsed into a semi-comatose and finally a comatose condition, and died about 7.0 P.M.

Post-mortem revealed no noticeable lesions.

Thinking that perhaps the toxic effect exhibited in Case 1 might have been due to some peculiar idiosyncracy of the animal, I dressed a fox terrier (Case 2) with an emulsion of creolin and water, but the result was just as unfortunate.

CASE 2.—Fox terrier dog, four or five years old, 13½ lbs., fair condition and good coat.

12.35 P.M. Well applied for ten minutes with friction a mixture of 2 ounces of creolin and 4 ounces of water. Temperature before commencing 101·2°. Immediately after the application the animal showed signs of great irritation.

12.50. Staggering about; hind limbs particularly unsteady.

12.54. Prostrate; comatose; clonic convulsions of the voluntary muscles, especially of the limbs.

12.57. Temperature 98·1°. Clonic spasms of the muscles of the jaws well marked. Pupil of eye about three-fourths dilated.

1.4. Temperature below 95°, could not be registered. My own hands had a peculiar tingling sensation.

1.45. Temperature below 95°. Surface of body cold.

3.0. Body surface perceptibly colder, convulsive spasms much weaker. Pupil still about three-fourths dilated.

4.0. Convulsions very feeble indeed.

5.0 and 6.0. As at 4.0 P.M., but more feeble.

7.30. Was dead.

Post-mortem, made by Professor M'Fadyean. Skin still smells of creolin. When the body was opened there was a distinct odour of creolin in the internal organs, even when they were taken out and removed some distance away from the skin. Heart, all the cavities were distended with black blood clots. Stomach contained a slightly blood tinged fluid with a distinct odour of creolin; mucous membrane deeply congested. Small intestines contained slightly blood-stained contents with a strong smell of creolin. There was intense hæmorrhagic inflammation of the duodenal and jejunal portions, and slight congestion of the rest of the small intestine. Kidneys somewhat congested. Bladder contained a small amount of a milky looking fluid, the mucous membrane being slightly congested. Brain, vessels of the pia mater distended with dark blood.

Thinking that it would be of practical value to know what amount could be applied with safety to the dog, I took careful note of all cases dressed with creolin, and herewith append the most important of them.

The creolin used in each case, unless otherwise mentioned, was Jeyes', of the quality sold and labelled "For dispensing purposes."

CASE 3.—Manchester terrier, about 15 lbs., suffering from sarcoptic mange.

11th February. Dispensed an emulsion of creolin (2 drachms) and water

sufficient to fill up a 6 ounce bottle, giving the owner instructions to apply it thoroughly all over the body.

15th February. Animal returned; had shown signs of irritation when the dressing was applied, but no toxic symptoms.

CASE 4.—Mongrel collie pup, dog, six weeks old, good condition and thick coat, 4½ lbs., suffering slightly from sarcoptic mange.

8th February, 11.12 A.M. Thoroughly applied all over the body with friction for five minutes, 1 drachm of creolin to 2 ounces of water. Immediately after the application was finished the dog showed signs of violent irritation, whimpering and rubbing against articles.

11.24. Staggering gait; apparently unable to see distinctly.

11.27. Sitting still and whimpering all the time.

11.35. Not whimpering; sitting still; slight but distinct twitching of end of tail.

11.40. Body surface very cold. Temperature 95·2°. Placed in a hot bath at once; thoroughly scrubbed and fomented the skin. Dried thoroughly with friction.

11.50. Temperature 95·7°. Placed in a warm room.

12.0. Sitting quiet, no signs of irritation. Skin still smells very perceptibly of creolin; applied friction again. Temperature 96°. Administered a stimulant composed of spts., eth., nit., and liq., ammon., acetatis.

1.0 P.M. Temperature 99·4°. Body surface warm. Dog ate some meat and seemed brighter. Repeated stimulant medicine.

2.45. Temperature 100°. Animal constantly scratching body. Repeated stimulant.

4.30. Temperature 102°. Constantly scratching at head and ears.

9th February. Apparently all right.

10th February. Coat very harsh to the touch; epidermis peeling off in large scales all over surface of body.

11th February. Sent home. This animal was seen again on the 15th, and it had then recovered from the effects of the creolin, but was not yet cured of the mange.

CASE 5.—Bull terrier, sarcoptic mange. Dressed thoroughly with an ointment composed of 1 ounce of creolin to 7 ounces of lard; half the body was dressed at once and the remainder three days later. No bad result ensued.

CASE 6.—31st January. Retriever dog, good condition, covered with lice. Dressed thoroughly all over the body with an ointment composed of 1 ounce of creolin to 7 ounces of lard. This was washed off five days later; the animal ate well and did not appear ill or in any way inconvenienced.

6th February. Dressed again as above, and washed off on the 11th.

12th February. Animal had not been inconvenienced in any way. No bad result ensued.

CASE 7.—Manchester terrier, 11 lbs., good condition, sarcoptic mange. Dressed well with a mixture of 2 drachms of creolin to 4 ounces of water, and repeated the dressing three days later. No bad result ensued.

CASE 8.—Toy Yorkshire terrier, three or four years, about 8 lbs. Dressed with aqueous solution of creolin (1 in 30) all over the body, applying thoroughly about 2 ounces of the solution (containing about half a drachm or so of creolin). Ten minutes later the animal was noticed to be prostrate and showing clonic spasms of the voluntary muscles. A hot bath was at once prescribed, and the unabsorbed creolin washed off. Recovery finally ensued, but the animal was dull all that day and the day following.

CASE 9.—Mongrel wire-haired terrier, about two or three years, good condition, long and thick coat; weight 26½ lbs.

27th January, 12.55 P.M. Temperature 101·3°. Applied thoroughly with friction for seven minutes 2 ounces of creolin to 6 ounces of water.

1.0. Animal whimpering and showing signs of violent irritation before the application was ended. As soon as he was set at liberty began to run about, whimpering.

1.10. Irritation seemed passing off.

28th January, 10.0 A.M. Apparently well; feeding heartily.

5.0 P.M. As at 10.0.

29th January. Showed no harmful effect; the effect was undoubtedly lessened on account of the length and thickness of the coat.

CASE 10.—Fox terrier bitch, good condition, about 14 or 15 lbs.

17th January, 4.45 P.M. Temperature 102·4°. Applied thoroughly for eight minutes a solution of 1 ounce of creolin to 7 ounces of water.

4.55. Animal greatly irritated, rubbing body on the straw, etc.

5.10. Irritation had almost passed off.

6.30. No signs of irritation.

10.0. As at 6.30.

18th, 19th, and 20th January. Appeared to be quite normal; feeding well.

CASE 11.—Fox terrier bitch, about two years old, 19 lbs. weight, good condition and with a thick coat. Rectal temperature before commencing 102·1°.

12.28 P.M. Well applied with friction for seven minutes all over the body a mixture of 2 ounces of creolin to 4 ounces of water. Heat was evolved during the application, the skin steaming very much; immediately after the application was finished the dog showed signs of violent irritation, constantly shaking the whole body and rubbing against things. This lasted for about fifteen minutes and gradually subsided.

1.5. Irritation had apparently all passed off.

1.10. Temperature 101·9°. No signs of irritation.

4.0. Apparently all right. Destroyed by a dose of hydrocyanic acid.

Post-mortem revealed no abnormal appearance of the internal organs.

CASE 12.—Retriever, aged, fat, 54 lbs. weight.

1.15 P.M. Temperature 102·2°. Coat partly clipped off, but the roots left were very thick, so that the dressing could not very readily come into direct contact with the skin itself. Well applied with friction for ten minutes a mixture of 4 ounces of creolin and 8 ounces of water. This produced a certain amount of irritation, which had passed off completely at 1.40.

1.40. At this time my own hands were very numbed and had a most peculiar tingling sensation.

2.0 and 4.0. Dog seemed all right; fed well.

10.0. No signs of toxic effects. Destroyed with chloroform.

Post-mortem revealed nothing abnormal.

CASE 13.—Fox terrier bitch, about twelve months old, weight 8½ lbs., poor condition, but otherwise healthy.

17th January, 4.30 P.M. Applied with friction thoroughly for seven minutes a solution of 6 drachms of creolin in sufficient water to make up 4 ounces. As soon as the application was finished the animal ran about as if violently irritated.

4.55. The irritation appeared to have all passed off; animal sitting still, looking dull and dejected.

5.0. Ate meat readily.

5.10. No further signs of irritation.

6.30. Animal quiet and showing no signs of irritation.

10.0. Dog appeared in normal condition.

18th January. Nothing noticeably wrong with dog; ate food.

19th January. As on 18th; feeding well.

20th January, 1.45 P.M. Dog appeared well, temperature 100·8°. Applied thoroughly with friction for ten minutes an ointment composed of creolin 2 drachms, pot. carb. 20 grains, liquor potassæ 1 drachm, and lard 2 ounces. This did not appear at the time to cause any irritation.

2.0. Slight signs of irritation.

3.0. No apparent signs of irritation or distress.

5.0. Temperature 98°. Staggered when walking. Ate meat. No signs of irritation except slight rigors.

21st January, 9.0 A.M. Dead. Body quite cold.

Post-mortem, 9.30 A.M.—Skin smelled strongly of creolin. Lungs intensely congested. Heart, all the cavities (especially on right side) full of dark black blood. Trachea and pharynx normal. Stomach full of food; mucous membrane congested. Small intestine contained throughout its whole length a quantity of black or dark brown semi-fluid contents with faint smell of creolin; large intestine contained black semi-fluid contents with a distinct smell of creolin. The mucous membrane of each intestine was normal. Bladder, mucous membrane normal, urine dark brown in colour with an odour like carbolic acid; a little of it displayed in the light gave a distinct play of coal-tar colours. Brain, vessels of the pia mater congested.

CASE 14.—Mongrel, very fat, weight 32 lbs., thick coat.

21st January, 12.5 P.M. Temperature 100·8°. Well applied for ten minutes with friction a mixture of 2 ounces of creolin to 4 ounces of water.

12.15. Irritation not so well marked as usual; animal only slightly affected.

1.15. Temperature 100·8°. No signs of irritation in the dog, but my own hands were still tingling and felt very hot.

5.0. As at 1.15.

22nd January, 10.0 A.M. Temperature 100·7°. Feeding well; skin still smelling of creolin. Dressed again thoroughly for ten minutes with a mixture of the same proportions as on the previous day.

10.15. Slight signs of irritation.

11 A.M. to 5.0 P.M. Seemed dull, but fed heartily.

23rd January, 10.0 A.M. Seemed all right; fed well.

1.30 P.M. Dressed again thoroughly for five minutes with a similar mixture in the same proportions. This caused more irritation than either of the previous dressings, but it passed off after about fifteen minutes.

24th January, 10.0 A.M. Feeding well; had vomited once.

4.0 P.M. Dull and disinclined to feed.

25th to 29th January. No signs of toxic effects manifested. Skin was tender to the touch. Was well washed, after which a number of eczematous sores were visible along the back where the most friction had been applied; these were especially noticeable, too, just where the skin of the neck was wrinkled and furrowed. They were all tender to the touch. Temperature 100·8°.

30th January. Animal seemed dull and depressed.

31st January to 2nd February. Sores healing well and becoming drier; animal brighter.

3rd February. Still one moist sore; the others were dry and the upper layer of skin and hair peeling off. Appetite improving.

4th February. Sores all healed. Dog lively.

5th and 6th February. Dog apparently all right.

7th February, 12.55 P.M. Temperature 101·8°. Apparently all right. Well applied with friction for seven minutes, all over the body, a mixture of 4 ounces of creolin and 4 ounces of water. Before the application was finished the animal showed great signs of irritation.

1.4. Gait very unsteady; staggered when walking.

1.8. Unsteadiness more marked than at 1.4, especially noticeable in hind limbs.

1.9. Hind quarters paralysed.

1.11. Fell and could not rise.

1.15. Temperature 99·6°. Semi-coma; clonic spasms of the voluntary muscles, especially of the hind quarters, jaws, and eyelids.

1.20. Complete coma. Pupil about two-thirds dilated; did not react to artificial light.

1.30. Temperature 96·4°.

1.36. Temperature below 94°; could not be registered.

2.20. As at 1.20, but the spasms perceptibly weaker.

3.30 and 4.30. As at 2.20, but weaker; body surface very cold.

5.0. Weaker.

5.30. Dead.

Post-mortem, 8th February, 10.0 A.M.—Skin still very distinct smell of creolin. Right lung showed hypostatic congestion. Heart, both auricles and ventricles were full of thick, black, clotted blood. Bladder about one-third full. No smell of creolin noticed in any of the internal organs.

CASE 15.—Cat, male, about one year old, healthy. Temperature before commencing 100·8° (animal had been kept quiet for twenty-four hours previously).

12.40 P.M. Applied thoroughly with friction for ten minutes a solution of 1 ounce of creolin to 3 ounces of water. The animal was not seen between 12.50 and 1.30.

1.30. Cat lying prostrate, hind quarters particularly affected, being completely paralysed. Clonic convulsions of head and all the limbs, which were twitching spasmodically. Frothy mucus in the mouth and around the jaws, due to the convulsive movements of the lower jaw. Dull, semi-comatose. Pupil of eye about three parts dilated. Temperature below 95° (apparently about 93°).

2.20. As at 1.30, only perceptibly weaker. Quite comatose.

3.30. As at 2.20 but much weaker. No mucus around mouth or lips. Temperature too low to register (apparently about 93°).

6.15. Dead. Body cold. Few bubbles of froth at back of pharynx. Pupil about three parts dilated.

Post-mortem.—11.30 P.M. Smell of creolin very distinct on body. Lungs normal. Larynx contained a little frothy mucus. Trachea empty, normal. Heart, both auricles distended with black blood clots. Right ventricle full of black clotted blood. Left ventricle full of black fluid or semi-fluid blood. Stomach contained a small amount of fluid material. Intestines normal. Bladder distended with urine.

CASE 16.—Cat, good condition, sarcoptic mange on head and shoulders.

29th January. Applied thoroughly an ointment containing 30 minims of creolin to 8 drachms of lard to the head and shoulders twice daily.

3rd February. This was changed for a lotion containing half a drachm of creolin to 2 ounces of water, applied every third day.

13th February. This was again changed to an ointment containing 1 drachm of creolin to 6 drachms of lard. To be applied once daily for four days and then to be washed off.

March. No toxic effects had been noticed.

CASE 17.—Cat, male, good condition, 9 lbs. weight, suffering from sarcoptic mange.

1.0 P.M. Well applied with friction all over the body for seven minutes, a mixture of 1 ounce of creolin (Whalley's) and 3 ounces of water.

1.7. Signs of irritation.

1.9. Slight involuntary twitchings of the muscles.

1.12 Staggered, fell and could not rise; passed large quantity of urine; clonic spasms well marked.

1.16 Temperature 95·8°. Comatose; pupils about two-thirds dilated.

1.19. Temperature below 95°; too low to register.

1.20. Placed in a warm bath containing 4 ounces of magnesium sulphate to 40 ounces of water; changed the bath twice and rubbed the skin dry afterwards. Wrapped up well and placed in a warm place.

1.30. Temperature still below 95°. Gave little hopes of favourable result.

3.15. Dead.

Post-mortem, 4.0 P.M. Tongue cyanosed. Small quantity of froth at back of pharynx. Liver much congested, slight but distinct smell of creolin. Heart, each of the four chambers distended with black blood, and having a faint odour of creolin. Small intestines, contents had a faint but distinct odour of creolin.

CASE 18.—Cat, male, five or six months, about 7 or 8 lbs., thick coat, fair condition but suffering from mange.

12.36. Applied with friction 2 drachms of creolin (Whalley's) and 1 ounce 6 drachms of water for four minutes to the back, sides, and abdomen. The next day the animal seemed to be dull and sulky and would not feed; three days later it was dead, but without having shown any symptoms that could be attributed to the creolin except lassitude.

Post-mortem revealed nothing abnormal.

With the less refined form known as Jeyes' Fluid, or Jeyes' "Perfect Purifier," said to be perfectly harmless to animals and non-poisonous, the following observations were made:

CASE 1.—Wire-haired terrier, four or five months old, healthy, weight 9½ lbs. Coat fairly thick.

7th February, 3.35 P.M. Temperature 103·3°. Applied with friction for ten minutes a mixture of 1 ounce of Jeyes' "Perfect Purifier," and 1 ounce of water over the whole body.

3.43. Whimpering, shaking body and showing other signs of violent irritation, but playful. Constantly rubbing against things.

3.50. Still shaking body occasionally.

3.55. Well rubbed the skin again with hands moistened in water.

4.2. Irritation appeared to have completely passed off; the friction did not appear in any way to have increased the amount of irritation, although the skin was tender when being rubbed.

4.4. Again applied a solution of Jeyes' Fluid and water, 1 ounce of each thoroughly for five minutes.

4.20. The above application again caused irritation, but at 4.20 this had passed off.

4.30. No further signs of irritation.

5.0. Apparently all right.

8th February, 11.0 A.M. Animal appeared all right and fed heartily. Was placed in warm bath, the skin thoroughly fomented and washed.

9th February. Appeared all right.

10th February, 10.45. Animal apparently quite well and feeding heartily. Temperature 103°. Well applied with friction for five minutes a mixture of 1 ounce 6 drachms of Jeyes' "Perfect Purifier" and 2 ounces of water.

10.50. Animal showed signs of irritation and walked about with a very unsteady and staggering gait, the hind quarters being most affected.

10.55. Fell over and had difficulty in getting up; had quite lost control over the limbs. Body still irritated by the dressing.

10.58. Hind quarters perceptibly weaker.

11.0. Staggering about in circles.

11.2. Fell and could not rise. Was not comatose, as the mere introduction of the thermometer caused the animal to make signs of disapproval. Temperature 98·4°. Clonic spasms of the muscles of the hind limbs well marked.

12.0. Clonic spasms of all the voluntary muscles of the body, especially of the limbs. Prostrate, not comatose.

12.30 P.M. As at 12.0; only semi-comatose; was roused and evinced signs of consciousness when the temperature was taken; temperature 96·4°.

1.15. Was apparently recovering; quite conscious and could raise head; spasms of the muscles much less violent.

2.0. Improving.

3.30. Could walk, though unsteadily.

4.0. As at 3.30; appeared certain to recover.

11th February, 9.0 A.M. Was dead and cold; body was lying on sternum and abdomen with head slightly inclined to the right side, the fore legs spread apart; it seemed as if the animal had fallen forward and died almost without a struggle.

Post-mortem.—9.30 P.M. Body rigid, in a very peculiar distorted position; a quantity of frothy mucus present in the mouth and around the lips. Skin still smells of Jeyes'. Heart, all the cavities empty; heart muscle very flaccid. Lungs normal. Larynx and back of pharynx contained a small amount of frothy mucus. Stomach was almost full of dark fluid. Small intestine also contained dark semi-fluid material; mucous membrane normal. Large intestine normal. Bladder almost empty; mucous membrane normal. Brain, vessels of pia mater congested. Could not detect any smell of Jeyes' in any of the internal organs.

CASE 2.—Fox-terrier bitch, about one year old, 12½ lbs., healthy.

7th February, 4.32 P.M. Somewhat excited. Temperature 102·5°. Applied with friction for ten minutes a mixture of 2 ounces of Jeyes' "Perfect Purifier" undiluted.

4.45. Only evinced slight signs of irritation; not at all so well marked as when mixed with water, or as produced by creolin.

4.47. Dull, shaking body occasionally.

4.55. As at 4.47.

8th February, 11.0 A.M. Apparently all right. Skin well washed. Good appetite.

9th February. Apparently all right. Feeding well.

10th February, 11.7 A.M. Temperature 101·2°. Well applied with friction for seven minutes an emulsion composed of 3 ounces of creolin to 5 ounces of water.

11.14. When the application was completed the animal staggered with a stilty gait, and a minute later fell over.

11.15. Could not rise; clonic spasms of all the voluntary muscles of the body, especially well marked in the legs, head, jaws, and eyelids. Jaws snapping together at short intervals. Semi-coma. Pupils slightly dilated.

11.18. Temperature 100·9°.

11.23. Temperature 97·2°.

12.30 P.M. Spasms very feeble; temperature too low to register; respiration very spasmodic, sighing and irregular.

1.15. Weaker.

2.0. Dead.

Post-mortem, 4.0.—Heart, both auricles and ventricles packed with black clotted blood. Lungs normal. Stomach contained a dark-coloured fluid with a distinct smell of creolin. Small intestine, contents did not smell at all of creolin. Liver showed marked congestion. Bladder about one-third full. Brain, congestion of vessels of pia mater.

CASE 3.—Fox-terrier dog, fifteen months, 18½ lbs. weight, good condition and thick coat.

5.5 P.M. Well applied with friction for ten minutes a mixture of 5 ounces of Jeyes' "Perfect Purifier" and 3 ounces of water. Temperature before commencing 102·8°.

5.10. Showing signs of great irritation.

5.20. As at 5.10.

5.25. Temperature 101·4°. Staggering gait, slight clonic spasms. Noisy respiration, especially well marked during inspiration; semi-coma; mucus collecting around the lips owing to the clonic spasms of the jaws.

5.40. Complete coma. Violent clonic spasms, especially well marked in limbs and jaws.

5.52. Temperature 96·8°. Own hands do not feel the same burning sensation as with creolin.

7.0. Spasms much weaker; body surface becoming very cold.

Death occurred during the night.

Post-mortem next day.—Skin still smells very strongly of Jeyes' Fluid. Heart, all the cavities were full of black blood clots. Lungs normal. Stomach full of food, mucous membrane normal, no smell of Jeyes'. Small intestine, no smell of Jeyes', normal. Large intestine contained fæces having a distinct odour of Jeyes'. Bladder, mucous membrane normal, contained a small amount of urine which did not smell of Jeyes'.

CASE 4.—Irish-terrier dog, six or eight weeks old, weight 8 lbs., thick coat.

11.28 A.M. Temperature 102°. Applied with friction for seven minutes a mixture of half-an-ounce of Jeyes' "Perfect Purifier" and 3½ ounces of water.

11.35. Symptoms of violent irritation, but not so severe as when using creolin. Body steaming.

11.40. Irritation appeared to have almost passed off.

11.48. Symptoms of slight irritation occasionally.

11.54. Temperature 98·8°. Animal sitting still; dull.

12.0. Well applied with friction for five minutes a mixture of the same proportions and amount as at 11.28.

12.6. Walked about unsteadily; very dull.

12.7. Fell down and rose with difficulty.

12.8. Fell again and could not get up.

12.12. Temperature 95·4°. Animal lying prostrate. Clonic twitchings of the whole of the body, especially of the hind limbs. Pupil of eye did not react to artificial light, and was about two-thirds dilated.

12.25. Temperature below 95°. Semi-comatose. Pupil as at 12.12. Clonic spasms of muscles more violent, the jaws occasionally convulsively snapping together.

12.35. Not totally comatose; responded readily to stimuli. Spasms of jaws more frequent. Pulse at femoral artery and the heart-beats in the region of the thorax were too much accelerated to be able to be counted.

12.45. As at 12.35, but weaker. Own hands still felt very hot and had a burning sensation, but not nearly so severe or unpleasant as after applying creolin.

7.0 P.M. Dog had apparently recovered completely; was lively and could run about well. The coat was dry and somewhat harsh to the touch, but not nearly to the same extent or so sticky as after the application of creolin. Destroyed by hydrocyanic acid.

Post-mortem two days later.—Skin still had a strong smell of Jeyes' Fluid. There was a distinct smell of Jeyes' in the contents of the large intestine, but not the slightest perceptible smell in any of the other organs.

CASE 5. Mongrel fox-terrier and pug, aged, very fat; weight 15½ lbs.; had long and thick coat.

6th February. Temperature 101·6°.

11.5 A.M. Well applied for five minutes a mixture of 1 ounce of Jeyes' Fluid and 1 ounce of water to abdomen and back.

11.15. Running about at intervals, but not showing signs of very great irritation.

12.30 P.M. Nothing abnormal noticeable.

2.50. Temperature 100·9°.

2.55. Apparently all right. Applied thoroughly for five minutes 1 ounce of creolin mixed with 3 ounces of water.

3.0. Only exhibiting signs of slight irritation (doubtless largely due to the amount of fat covering the body).

11.0. Apparently quite well.

Next day, 10 A.M. Apparently quite well. Destroyed quickly with chloroform.

Post-mortem revealed nothing abnormal.

CASE 6.—Yorkshire terrier, one or two years old, weight 19 lbs, in good condition but suffering from follicular mange.

10.20 A.M. Temperature 101·9°. Well applied for five minutes 1 ounce of Jeyes' Fluid undiluted to a large patch under the throat and under surface of abdomen. Immediately after the application the animal ran about showing signs of irritation.

10.37. Irritant effect had almost passed off.

12.30. Nothing abnormal noticeable.

4.0 P.M. Apparently all right; destroyed with hydrocyanic acid, as owner then came to the decision that he would not proceed further with the treatment.

Post-mortem revealed nothing abnormal.

One of the following cases illustrates that the preparation known as Whalley's "Celebrated Disinfectant" (which is not unlike Whalley's creolin in smell and appearance, and which is said to be perfectly harmless for the horse, sheep, dog, and other animals), must be used with care.

CASE 1.—Mongrel dog, 9 lbs., poor condition, fair coat.

3rd March, 11.35 A.M. Applied with friction for four minutes all over the body a mixture of 1 ounce Whalley's "Celebrated Disinfectant," and 3 ounces of water. This caused only a slight amount of irritation for a few minutes, after which the dog seemed all right. The amount of irritation was not in any way to be compared with that produced by creolin.

5.0 P.M. Feeding well; apparently quite well.

4th March. Bright and lively, good appetite. Was well washed at 3 P.M.

5th March. Apparently quite well.

6th March, 9.45 A.M. Temperature 100·5°. Well applied with friction for ten minutes a mixture of 3 ounces of Whalley's "Celebrated Disinfectant," and 3 ounces of water. This only caused a very slight amount of irritation, which did not last more than about five minutes.

10.15. Nothing abnormal noticeable; own hands felt dry but not burning as after applying creolin.

12.40 P.M. Temperature 98·8°. No toxic effects manifested.

4.0. Fed well; apparently all right.

7th March. Apparently all right. No further symptoms developed.

8th March. Dull, but ate some food.

9th March. Skin very tender to the touch.

10th March. Skin very tender; upon examination it was found to be covered with eczematous sores. The animal was at once placed in a hot bath, as much of the dressing as possible being soaked off and the skin well formented.

11th March. Partial paralysis of the hind quarters and dulness. The owner was advised to have the animal destroyed, and a dose of hydrocyanic acid was administered.

Post-mortem, made a few hours later, revealed no noticeable lesions except on the skin.

CASE 2.—Fox-terrier dog, about two years old, weight 15 lbs., in fair condition but affected with follicular mange. There was no hair present under the neck, breast, and upper part of the fore limbs; the rest of the body was clipped.

22nd February. An ointment composed of 4 drachms of creolin (Whalley's) to 4 ounces of lard was thoroughly applied all over the body by the owner, who stated that he noticed no irritation. This was washed off on the 26th, and the animal was brought back for re-inspection. There appeared no change in the general appearance of the animal.

28th February. The coat was clipped.

29th February, 11.25 A.M. Applied thoroughly all over the body for twelve minutes an emulsion composed of 1 ounce of creolin to 7 ounces of water (which had been prepared the previous evening). During the application and immediately after it was completed the dog showed very great signs of irritation; when allowed to go the gait was very unsteady.

11.40. Animal fell and could not rise; prostrate; clonic spasms of voluntary muscles, especially well marked in those of the limbs and jaws. Not comatose.

11.55. Placed in a hot bath, the skin being thoroughly washed and soaked. Rectal temperature 96·4°. Body dried thoroughly with friction and covered up with straw in a warm place.

1.30 P.M. Dog walking about, though a little unsteady. Temperature 99·8°; looking bright and quite sensible. Still slight rigors.

4.0. Dull, otherwise all right.

1st March. Appeared all right; feeding well; skin moist in places.

2nd March. Skin dry and scaly in places. Feeding well.

3rd March, 11.30 A.M. Dressed head, neck, chest, and forelegs only with a mixture of 1 ounce of creolin to 1 ounce of water; this was thoroughly applied for three minutes. Immediately the dog showed signs of violent irritation and staggering gait, and about two minutes later fell down unable to rise. The dressing was at once washed off with cold water, and friction and warmth were applied to the skin. By this time (about ten or fifteen minutes after the application) the rectal temperature had gone down to 95·2°. Not comatose.

12.10 P.M. Recovering well, attempting to get up but very unsteady.

1.30. Can walk well; apparently out of all danger.

4th March. Somewhat dull; otherwise all right; fed well.

5th and 6th March. Apparently quite well. Lively; good appetite.

7th March, 11.35 A.M. Well applied all over the body with friction for seven minutes a mixture of 4½ ounces of Whalley's "Disinfectant" and 2½ ounces of water.

11.50. Showing signs of irritation (though not so violent as when rubbed with creolin); staggering about.

11.55. Prostrate, complete coma; clonic spasms of the voluntary muscles, particularly of the limbs and jaws.

12.5 P.M. Temperature 95·4°. Placed into a hot bath; washed and fomented the skin; applied friction and wrapped up well.

12.15. Hypodermic injection of ether (15 minims). This injection was repeated every hour till 2 A.M.

7.0. Animal could walk, but very unsteadily; managed with difficulty to eat some small pieces of meat. Still showed clonic spasms, but not so violently. Surface of body cold; wrapped up and placed near a fire.

8th March, 9.0 A.M. Not much improvement; gave hypodermic injections of ether, but animal died about three o'clock.

Post-mortem, 9th March. Heart, each chamber was full of black blood clots with a faint peculiar odour. Liver, faint peculiar odour, suspiciously like that of Whalley's "Disinfectant." Small intestines contained semi-fluid material with a distinct odour of the disinfectant. Large intestines contained fæces with a more distinct odour of the disinfectant than the small intestine. Bladder about three-fourths full, the urine smelling distinctly of the disinfectant. In each case the odour was very evanescent, but was perceptible when the organs were carried some distance away from the body before being cut.

Knowing the great value of creolin as an antiseptic to wounds, and having established its toxic properties when absorbed from the surface of the skin, I took note of the following cases, which are of interest as showing that it is possible for it to become absorbed from a wound.

CASE 1.—Fox-terrier dog, 8½ lbs., suffering from a freshly incised skin wound.

26th February, 4.0 P.M. This was treated by being dressed with pure creolin, 2 drachms being placed on some wadding, the edges of the skin sutured over this, and the whole bandaged up carefully.

27th February. As the parts appeared tender and slightly swollen the bandage was removed.

28th and 29th February. The swelling was much more tender and as large as a hen's egg; the animal not being quite so lively. There was no pus discharging from the wound, which appeared quite aseptic.

1st March. From the lower orifice of the wound, below the last stitch, there was a mucilaginous discharge, in consequence of which the stitches were released. The wound was found to be perfectly aseptic, but the emulsion of creolin formed with the fluid of the tissues was causing the muscle underneath to have a macerated appearance, and was commencing to burrow its way downwards. The dog was feeding well, bright and lively.

After this the wound was left open and treated with other dressings, the dog never showing any toxic symptoms and making a good recovery.

CASE 2.—Fox terrier, aged, weight 18 lbs., healthy, suffering from a fresh wound about 2 inches long in the skin of the back.

10th February, 1.25 P.M. Temperature 101·2°. Applied 4 drachms of pure creolin on cotton wool to this, sutured part of the skin, and bandaged thoroughly.

2.0. Dog seemed comfortable and showed no signs of irritation.

4.0. Seemed all right.

11th February, 10.0 A.M. Seemed all right but dull.

12th February. Very dull and disinclined to move. Not feeding.

13th February, 9.0 A.M. Temperature 95·2°. Unable to rise, though constantly attempting to do so; no appetite; diarrhœa; body surface very cold.

12.30 P.M. Lying prostrate. Temperature below 95° (thermometer would not register). Respirations 12, very irregular. Pulse 32, very slow and weak. Semi-comatose, but could be roused after some trouble. Weak clonic spasms of all the voluntary muscles at intervals of fifteen to twenty seconds.

1.30. As at 12.30 but perceptibly weaker.

3.30. Dead and cold.

Post-mortem, 14th February, 9 A.M. Revealed the cotton-wool to be still smelling strongly of creolin, some of the emulsion of which (of a dirty milky colour) could still be squeezed out. The surrounding muscular tissue

was paler in appearance than normal (as if macerated), and a quantity of the thin milky fluid had penetrated subcutaneously for about an inch each way. There was no noticeable smell of creolin in any of the internal organs; the heart was filled in each cavity with dark blood clots.

In order to test the exact amount which, if absorbed into the system, would cause death, and also to test its value in the treatment of follicular mange when used subcutaneously, I made the following observations.

CASE 1.—Retriever dog, six months old, about 30 lbs., in poor condition and suffering very severely from follicular mange, having raw patches on head and forelegs.

13th February, 9.30 A.M. Dressed the head and forelegs thoroughly for seven minutes with an ointment composed of 1 ounce of creolin to two ounces of lanolin with a drachm of carbonate of potash.

10.0 P.M.—Slight irritation; not anything like that produced by the lotion, and only such as would be produced by any greasy application to the face.

1.0. No signs of irritation.

14th February. No signs of bad effect from the creolin; dog hearty and feeding well.

15th February, 1.0. P.M. Injected subcutaneously in the right flank a mixture of 3 drachms of creolin and 3 drachms of water; also subcutaneously in the region of the lips and on one leg, where the effects of the parasite were most marked, a mixture of 1 drachm of creolin to 1 drachm of water.

1.30. Dog quieter than before the injection; no signs of irritation.

3.0. Much quieter.

16th February. The parts which had been injected were swollen and painful.

17th February. Swellings much larger and very tender on pressure. Dog feeding well and fairly bright.

18th February. Swellings larger and very tender; that on the head had burst and was discharging a slimy emulsion-like fluid, smelling slightly of creolin. Dog listless.

19th February. Feeding well, but dull. Swelling on head had almost emptied itself; that in flank was larger.

20th February. Dog brighter and feeding well.

21st February. Swelling under flank had burst and almost emptied itself; not nearly so tender.

22nd to 28th February. The wounds healed up; dog appearing all right.

29th February, 11.40 A.M. Dressed thoroughly all over the body with an ointment of 2 ounces of creolin, 2 drachms of pot. carb., and 4 ounces of lanolin. This did not cause any signs of irritation.

1st and 2nd March. Dog feeding well.

3rd to 5th March. Apparently all right and hearty.

6th March. Apparently quite well. Skin was washed.

7th March, 11.25 A.M. Well applied with friction 8½ ounces of Whalley's "Disinfectant" undiluted; this caused signs of slight irritation for about five minutes.

12.0. No signs of irritation.

12.30 P.M. No signs of irritation.

7.0. Animal apparently all right; fed well.

8th March. Apparently all right; feeding well.

9th to 12th March. Constantly shaking body; no other signs of irritation.

13th March. Was well washed

14th to 20th March. No toxic symptoms of any kind had appeared; animal seemed lively, and fed well.

CASE 2.—Fox-terrier dog, nine or ten weeks, weight 8 lbs.

17th February, 5.0 P.M. Temperature 102·2°. Subcutaneously injected a mixture of 30 minims of creolin and a drachm of water in the region of the right flank.

18th February, 10.0 A.M. Animal appeared dull and listless; much quieter than before the injection, but showing no signs of pain or irritation except when the swelling which had arisen at the seat of injection was pressed upon. Fed heartily.

19th February. Not so dull.

20th February. Swelling still exceedingly tender.

21st February. Swelling had burst and was discharging a fluid having an appearance like that of an emulsion.

22nd to 25th February. As on 21st, but swelling slowly emptying itself. Feeding well.

26th February. Swelling scarcely perceptible.

No further symptoms of note.

CASE 3.—Mongrel deerhound, nine or ten months old, weight 32 lbs.

15th February, 1.0 P.M. Injected subcutaneously under the flank and arm on the left side a mixture of 2 drachms of creolin and 6 drachms of water.

1.30. No signs of irritation, animal perceptibly quieter than before the injection.

3.0. As at 1.30.

17th February. Feeding well; there was a distinct swelling, tender on pressure, at the seat of injection. Animal unusually quiet; before the injection had been in the habit of continually barking.

18th February. Feeding well. Swelling as large as a Tangerine orange and very tender.

19th to 25th February. As on 18th.

26th February. As on 18th, except that the swelling was perceptibly smaller and not so tender.

27th February. Feeding well. As on 26th. Destroyed by chloroform.

Post-mortem, made at once, revealed no smell of creolin in any of the internal organs. At the seat of injection there was still a small amount of emulsion-like fluid; the surface of the muscles at this part for the space of 3 inches by 2½ was paler than normal, and looked as if it had been macerated. The interior and under surface of the muscle was normal in appearance.

CASE 4.—Retriever, aged, good condition, weight 70 lbs.

14th February, 11.0 A.M. Temperature 102°. Injected subcutaneously in five places on the right side between the axilla and thigh a mixture of 1 ounce of creolin and 2½ ounces of water.

12 15 P.M. Apparently not in any way irritated, but evinced signs of pain when the parts were pressed.

1.30. As at 12.15.

5.0. No perceptible change; feeding well.

15th February, 10.0 A.M. Dull and listless; only roused up with difficulty.

3.0 P.M. As at 10.0. Temperature 103·2°.

16th February. As on 15th.

17th February. Feeding fairly well; not so dull. Large swelling about size of hen's egg at seat of each injection, tender on pressure.

18th February. The whole of the subcutaneous tissues on the right side were swollen, fluctuating, and tender to the touch. Dog listless.

19th February. As on 18th.

20th February. Swelling was less tender but more fluctuating, and appeared more diffused.

Destroyed at 12.30 P.M. by hydrocyanic acid.

Post-mortem, made at once, revealed no smell of creolin in any of the internal organs except the large intestine, in the contents of which it was distinct. The whole of the subcutaneous tissues on the right side were under-run by a dirty greyish-white emulsion smelling strongly of creolin; this extended upwards a little higher than the middle line of the ribs, and downwards as far as the linea alba. The muscular tissue underneath the skin was much paler in colour than normal, and looked as if it had been macerated; it was easily torn, and its fascia had completely disappeared in places. This effect did not extend underneath the muscle.

The following observations are selected from a number of cases to illustrate some of the doses that can be given internally with safety.

CASE 1.—Collie dog, fair condition, 48 lbs. weight, suffering from tænia.

1.30 P.M. Received a dose of half-an-ounce of creolin in 1½ ounces of water, hardly any being lost in the administration.

2.0. Seemed sulky; licking lips occasionally; no signs of irritation.

4.0. Ate food heartily.

10.0. Had shown no signs of any ill effect, nor did anything of the kind eventually occur.

CASE 2.—Collie, eighteen months, about 35 lbs., suffering from tænia.

18th November, 1.0 P.M. Received a draught composed of 1 drachm of creolin to 7 drachms of water. The animal showed no signs of irritation and took it very well.

19th November. Feeding well. Received 2 drachms mixed with 6 drachms of water, all being successfully administered.

20th November. Feeding well; fæces normal; received 2 drachms, as on the 19th.

21st November. Received 2 drachms, as on 19th.

22nd November. Received 2 drachms, as on 19th. Fæces had a distinct odour of creolin.

23rd November. Received 2 drachms, as on 19th.

24th November. Draught not given.

25th November. Feeding well; fæces not smelling of creolin; received about 1½ drachms of creolin in water (some of the 2 drachms getting spilled). Mucous membrane of the mouth quite normal.

26th and 27th November. Administered 2 drachms, as on the 19th. Animal feeding well; nothing abnormal noticeable.

The administration was then stopped, and nothing further of interest occurred.

CASE 3.—Pug, suffering from ascarides and diarrhœa.

14th January. Received a dose of purgative medicine, followed by 10 minims of creolin to a teaspoonful of water twice daily.

18th January. Diarrhœa much improved; no more medicine given; owner had not observed any worms in the fæces.

CASE 4.—French poodle, suffering from tænia.

3rd February. A draught composed of thirty minims of creolin to 2 ounces of water was given.

4th February. Owner said dog had passed a number of tapeworms. Administered a second dose containing 30 minims of creolin, 2 drachms of castor oil, and 2 ounces of water, but did not hear the result of this.

CASE 5.—Manchester terrier, about 12 lbs., suffering from tænia.

5th February. A draught composed of 20 minims of creolin, 4 drachms of castor oil, and 2 drachms of water was administered.

6th February. Owner returned and said that dog had passed tapeworms twice with the fæces.

Was feeding well but had been sick the previous evening.

From the foregoing observations the following conclusions may be drawn:—

That creolin is a narcotic and irritant poison to the dog and cat, and that its use in these animals must be watched with the greatest care.

That it is especially toxic when spread in emulsions of a certain strength over a large area of the body.

That its effect is more rapidly seen and more violent when mixed with water than when applied pure or when mixed up into the form of an ointment.

That when mixed with water in certain proportion and applied externally it will act as a violent irritant.

That the less refined preparation of creolin is not so toxic in action as pure creolin.

That it is not so readily absorbed from the stomach, from small wounds, or from the subcutaneous tissues, as from a large area of skin surface.

The toxic doses are somewhat difficult to determine with absolute accuracy, on account of the various delicate and coarser breeds of dogs with which we have to deal.

In dealing with very young animals especial caution is certainly necessary; this is well illustrated by Case 4, in which a collie pup, six weeks old and weighing 4¼ lbs., showed toxic symptoms from the application of only 1 drachm of creolin in 2 ounces of water. The length of coat, condition of the animal, and the thoroughness of the application, have also to be taken into account. Certainly in the more delicate breeds of dogs and in cats it would be unwise to apply with friction to any large area of the body, in such a manner that it would become absorbed, a preparation containing more than 10 or 15 minims per pound of body weight. It will be noticed that even in a hardy dog like a fox terrier 1 ounce has produced toxic symptoms, and would certainly have produced death had not treatment been commenced at once.

Two ounces in the form of emulsion with water is a tolerably certain toxic dose for a terrier in good condition, say about 12 or 14 lbs. weight, if brought well into contact with the skin; and 4 ounces for a dog of 30 lbs. or so.

Case 2 is also an illustration of the fact that it is not necessary to apply the preparation all over the body to obtain toxic symptoms.

Case 14 well illustrates its irritant effects, and shows that creolin dressings, if at all concentrated, should not be applied too frequently to the same place. I had also ample proof of this from the sensation in my own hands after applying the dressings, as for some hours after I could feel a numbed and burning sensation, and for the whole of the next day I could not bear to touch flannel or woollen goods, and on the third day the epidermis peeled off, giving them a very unpleasant harsh feel. On one occasion I used a little in a bath, but soon found it unendurable, and I should certainly think that in medical practice, where it is used for leprosy and other skin affections, care and judgment must be exercised as to the proper strength.

I think, too, that its action in emulsion is more violent when it is well mixed and allowed to stand for some hours before using, than when made and applied a few minutes later.

Of the toxic symptoms the first ones to be alarmed at are an

unsteady gait, the hind limbs particularly being affected, and an excessively subnormal temperature. This is followed by complete paralysis, prostration, and clonic spasms of all voluntary muscles, especially well marked in the limbs, jaws, and eyelids. There is a stage of semi-coma, followed by complete coma and death from collapse.

The *post-mortem* appearances to be especially looked for are:

The characteristic smell of creolin on the body, or in some of the internal organs, particularly in the contents of the large intestines, and occasionally of the bladder.

The heart cavities are filled with dark blood-clots, and the small blood-vessels congested throughout the body, this being particularly well marked in the brain.

In three of the cases I took some of the urine into the Chemical Laboratory, where it was tested by Professor Bayne, F.C.S., who found distinct traces of tar acids present.

With reference to the treatment, creolin appears to be excreted by means of the intestinal and urinary tracts, but the chief things to be combated are the tendency to coma and collapse. In several cases it will be seen that the treatment adopted with success was to wash and foment the skin thoroughly and give diffusible stimulants internally or hypodermically.

Case 1 shows that prognosis must be guarded, as even when an animal has apparently recovered it is by no means certain that a relapse may not occur.

STRONGYLUS TETRACANTHUS PARASITISM.

By HENRY C. WILKIE, F.R.C.V.S., F.Z.S., Cambridgeshire.

IT may be presumed that strongylus tetracanthus parasitism is not very common in many parts of the United Kingdom, as we rarely see reports of it in our periodical literature, and from its fatality in neglected cases, and the ravages it makes on the constitution in most cases, its importance can scarcely be over estimated. It is by no means uncommon, however, in the Cambridgeshire fens, more prevalent some years than others, but apparently always present, more or less, at that particular season of the year when the development of the parasite begins to give rise to symptoms which attract attention to the infested animal.

Those large expanses of grass land, usually submerged in winter and sometimes for a great part of the year, called the Washes, are utilised during the summer months as pasturage for horses and cattle, and it may be that this marshy land supplies suitable conditions for the hatching of the eggs of the parasite, and for the existence and development of the newly-born embryos.

I have had cases of this form of helminthiasis brought under my notice as early as December, but as a rule I think they are more numerous during the months of January, February, and March.

It would seem that about this time the larvæ, coiled up in the mucous membrane of the cæcum and the large colon, are approaching maturity; they have increased much in size, and many of them are

preparing to make a way through their epithelial covering, while some are already free in the lumen of the bowel and have reached their full development.

In their passage through the intestines many of these parasites attach themselves loosely to the walls of the small colon, and, when brought away with the fæces, are found more especially lying on the outside of the pellets—in cases where diarrhœa is not present—and but seldom inside of them.

When recently discharged they are quite the colour of arterial blood, but they dry up rapidly and the colour becomes darker, and they thus easily escape the notice of the casual observer. The colour soon fades too when immersed in any preservative fluid I have tried.

Perhaps the best is a solution of perchloride of mercury, but even in this the colour is not retained to anything like the brilliancy it has in the living parasite.

The female strongylus tetracanthus is seldom more than six-eighths of an inch in length, while few of the males reach a quarter of an inch. The hood, which is tri-lobed, has its lateral rays united into one mass below, and the posterior ray is split into four divisions, of which one might almost be said to be merely supplementary to the innermost.

The head of the worm is truncated and furnished with four well-marked spines (from which it derives its name); there are two papillæ on either side of the neck, and a large œsophagus with a well-marked œsophageal bulb.

The symptoms to which the presence of these parasites give rise are mainly those of anæmia, sometimes associated with obstinate diarrhœa. The visible mucous membranes are pale, the pulse is small, soft or thready, the eyes watery, and there is often a venous murmur to be heard over the jugulars at the breast. The temperature is frequently subnormal, appetite is usually impaired, often capricious; and indigestion, with abdominal pains, is by no means an uncommon complication. When diarrhœa sets in it is sometimes very profuse, and the excretions exhale a fœtid odour; emaciation is rapid, with pronounced debility, and if relief is not soon obtained death takes place from exhaustion.

This form of parasitism is not confined invariably to horses which have been summered on wash land, but is occasionally seen in those kept on fen farms.

One case of this kind which I had in January 1895 had a rapidly fatal termination. I first saw the patient, a shire filly, rising three years of age, on 10th January, and the history was that she had been out on fen seeds from May until December 1894, when she was taken into a straw yard, and fed on hay, chaff, and mangels. Diarrhœa commenced on 3rd January, and on the 10th the filly was extremely emaciated, the eyes watery, pulse feeble and thready, and the excretions very thin, frequently expelled, and fœtid in odour. The appetite was not quite lost, but for some days she had picked out the chopped mangels from her food, and eaten very little else.

On examining the excretions I found three or four specimens of the mature strongylus tetracanthus.

This filly was so greatly debilitated that I was obliged to prognose a fatal termination to the case, and she died on the morning of 12th January.

On *post-mortem* examination I found the cæcum and large colon almost covered on their mucous surfaces with the coiled up larvæ, some apparently nearly mature, while others were scarcely larger than a small pin's head.

I searched all through the alimentary canal, but failed to detect larvæ anywhere but in these portion of the bowels, where they were simply countless.

A few mature parasites were discovered free in the bowels, but these were very limited in number.

In the cæcum, several of the glands were enlarged, and contained pus, one being as large as a hazel nut, and containing three shrunken-looking larvæ in suspension.

I think about the most emaciated animal I ever saw was a mare infested with these parasites.

She was a three-years-old hackney filly, of considerable value, with a grand pedigree, and quite exceptional action. I saw her first in the month of March, and found she was passing the mature parasites in considerable numbers and with every excretion. She had little or no appetite except for what grass she could get, and her bowels were very irregular, constipation alternating with watery diarrhœa; the pulse was fairly full, but soft and greatly wanting in tone.

There was no cough, and no attacks of abdominal pain had been noticed. This mare had been out all the previous summer on the Washes, and had been in a straw yard during the winter feeding on hay, chaff, oats, and mangels, in addition to which she had been allowed to run in a grass field daily for a few hours.

She was in quite a remarkable state of emaciation; her eyes were sunken in their orbits, the anterior and posterior spinati muscles appeared to have practically wasted away, the back and ribs looked like nothing whatever but skin and bones, while the quarters showed the pelvic and hip-joint prominences to an extent, I think, I never saw before.

This patient was under treatment for about two months, during which time her capricious appetite almost exhausted our resources in trying to find things she would eat, but finally she began to improve in this respect, and made a good recovery. With this mare there were two others which had been out with her on the Washes, and in the excreta from these a few of the strongules were found. One of these mares had intermittent diarrhœa, with no loss of appetite, for about a month, while the other did not exhibit at any time signs of ill-health. They were both placed under treatment for a short time, and did not give much trouble, as the diarrhœa of the one was easily controlled, and probably neither of them harboured many of the parasites.

I think the strongylus tetracanthus used to be considered a rare parasite in England, and I remember seeing, in a somewhat old edition of Professor Williams' "Medicine," the question asked as to whether this form of parasitism was ever seen out of Iceland, or in other than Icelandic animals. It is certainly fairly common in the fens of Cambridgeshire, and I should be inclined to suppose it was once even more so, when the fen land was not so efficiently drained as it is at the present time, for it seems probable that the eggs require moisture for their hatching.

Treatment by 2 oz. doses of ol. terebinth. twice a week is in most

cases successful when commenced sufficiently early, but the parasites are so small as to be easily overlooked, and the loss of condition and diarrhœa are apt to be attributed by the owners of infested animals to some temporary and trivial cause.

I have occasionally made a *post-mortem* examination of one of these cases, where the animal has never been under treatment, not having been considered sufficiently ill to warrant the employment of professional aid.

CANINE RABIES IN INDIA.

By Surg.-Capt., J. C. VAUGHAN, I.M.S., Deputy Sanitary Commissioner, Western Bengal.

THE reading of a paper on rabies in India in the issue of this Journal for September 1895 has induced me to offer the following notes, which may perhaps prove of some interest.

I do not mean to offer any criticism of Vet.-Lieut. Martin's remarks in the paper above alluded to, but merely to set down certain facts which have come within my own experience. And while my own observations of the symptoms of rabies in dogs agree for the most part with his, there are also certain other points to which I would draw attention.

One of my earliest experiences of rabies was as a child, when one of my near relations was bitten on the face by one of our house dogs which was obviously rabid. The case was treated by my father in a manner afterwards to be referred to, and with a "successful result." My next experience was that of a big powerful man who died while under my treatment. All doubt in this case as to the diagnosis was set at rest by the history, and also by the results of experimental inoculations with portions of the medulla from the case. I was so impressed by this case that I have ever since made a point of carefully observing and noting all that has come in my way in the shape of canine rabies.

During the seven years or so of my service in India I have always kept dogs, and have lost four very valuable animals from rabies. As all these animals were valuable dogs, they were all kept as long as possible before being destroyed; and as their clinical history was much the same in all the cases, I will briefly summarise, and dwell only on the main points.

They were all large dogs. Three were of a cross between English greyhounds and Indian Rampore hounds, one was an imported Kangaroo hound, and all were of very docile temperament.

In every case the first thing which aroused my suspicions was an excess of freshness, a greater than usual display of affection for their master, and if anything a somewhat increased display of vigour and vitality in all they did, albeit combined perhaps with a slight nervous excitability in their manner; but there was no irritability or snapping at other dogs. With this there was, perhaps, a tendency to bark too much for no ostensible reason, or to bark now and again in isolated barks for nothing.

I have seen a good many rabid dogs, but have never noticed

the preliminary catarrh Vet.-Lieut. Martin speaks of. It did not occur in my dogs, in all of which the symptoms above detailed always appeared first, and always awakened suspicions, and that, as the event has proved, never as a false alarm. The leaving of food has in my experience always been a later symptom. My dogs have always been regularly hunted, and are always in the best of condition, and the symptoms above stated have always struck me as the first suspicious signs.

This excitability has shown a steady tendency to increase, and within twenty-four hours or a little more the look of increased "being alive to all about him" in the dog's eye has become dulled, and replaced by a kind of half-drugged "looking far-away" expression in the eyes and face, which is strangely out of keeping with the still somewhat restless and slightly excitable manner. At this stage, in my cases, the food has been eaten with an increased greed and haste; and though there has not been any tendency to attack other dogs so far, I have in two cases noted the dog to have developed a peculiar antipathy to the fowls and ducks about. There is still the curious isolated purposeless occasional bark, and although Vet.-Lieut. Martin says he cannot recognise the "rabid howl" of text-books, there is about this time a distinct change to my ear in the timbre of the full bark, which is distinctly hoarser in the loss of the higher overtones, and reminds one of nothing so much as of the brassy voice in the cough in advanced aortic aneurnism in man. In short, this voice condition is the first symptom of the weakening of the muscular innervation of the pharyngo-laryngeal region which is so distinctive of hydrophobia. At this time also may be noticed a frequent movement of the tongue, the dog "licking up the saliva in his mouth," as a friend once put it to me. Gradually the excited manner quietens down, and the whole deportment becomes more in keeping with the drugged look in the face and eyes, but the old excitement still occasionally breaks out, and the eyes flash up with a dull light in them.

So far we have reached the end of the second or third day. Now there is a period in which all excitement seems almost entirely to subside, but there are tremors in the limbs, subsultus tendinum in all four legs, and perhaps a quivering of the lower jaw, with a troubled restless snatchy sleep or doze, from which the dog awakes more restless than ever. He is now "quite mad," the old excitability has more than returned, the dead dull look is still in his eyes, which, when his attention is directed to anything, flash up wide open with dilated pupils, but the dull expression is not quite lost, and the contrast between expression and action, the now staring coat and "tucked up" appearance, and the slight stagger of the hind quarters which has now also developed, all together make up a picture it is hard to mistake. The brassy toneless bark has lost its overtones, and is constantly repeated in many cases, especially if the dog be tied up. The dog now refuses solid food though he may still take rice or soup. The temperature is raised, the urine high-coloured, and the fæces almost black. Though still docile, and glad to receive his master or visitors, perhaps with wagging tail and exalted demonstrations of affection, and if so, piteously out of keeping with his facial expression, it is now that he becomes uncertain. His jaws, perhaps, snap together on the coat sleeve he is licking in his excited affection, and he

bites without meaning to. If he attacks an unwary dog venturing near, it is with the same exuberance of action and mad display of whatever feeling is for the time uppermost, affection or animosity.

From this time on he seems gradually to lose his self-control, and so gradually becomes more and more dangerous. Even at their very worst, my cases have never altogether lost control of themselves, and I have gone, carefully gloved, up to my worst cases, and patted them and led them, and even when they have been secured with double chains and collars they have still known me and been quiet; but they have snapped their jaws on me, unintentionally, as shown by their manner, and have shown that the mental change—if one may use such a term for a dog—is essentially one of excitement with loss of control. The paralysis of the hind quarters and of the pharyngo-laryngeal region increases, and the period of excitement passes more or less quickly into one of deepening stupor, from which there are often sudden convulsive awakenings; the intervals between these grow longer, and finally death closes the pitiful scene.

I have watched the whole course of the disease carefully to the very end in one case of my own, and also in another case. In my other three I shot the dogs when they became unmanageable by the servants. I always tied them up when the dull look came into the eye, though I had watched them very closely before then.

It is clear that the disease I have sketched is the form known as "furious rabies." Dumb rabies begins much in the same way, in my experience. The restless sleep seems to me the turning point, and the dog wakes up paralysed and with dumb rabies, or with the "furious" form.

To my mind a very dangerous period is while the dog is in the preliminary stage of excitement, just before his expression changes, for the nature of the case is then so hard to recognise. But that it can be recognised is shown by my four cases, which occurred in November and in December 1892, in September 1894, and in September 1895 respectively.

The last case was that of the kangaroo hound. There were six of us at dinner after a day's shooting, when the dog suddenly came into the room, quietly enough, and one of the company called him to him; I then noticed the curious exuberance of the dog's manner, while being petted, and immediately stopped his familiarity and had him taken home and tied up. I did not then express my fears to our host, but my diagnosis proved fearfully correct. My servants would not believe it, but next day, when the brassy purposeless bark rang out, my head servant exclaimed "Sahib, 'Knight' is barking like 'Donovan,' who went mad so suddenly; is he going mad too?" I was evidently not the only one who had noted the peculiar bark of rabies!

I am aware that there are probably many points, which I have not touched on, such, for instance, as the eating of straw, chips of wood, apparent and perhaps real insensibility to pain and to certain stimuli, and hypersensibility to other stimuli, such as the mere whisking of a handkerchief over the face, and so on. I have not touched on "dumb madness" either, but my intention has been rather more to dwell on the preliminary or earlier symptoms, than to attempt anything like a full clinical treatment of the subject.

A point of very great importance which I would next touch on is

the question of the immediate treatment of bites from rabid or doubtful animals. With my own dogs out jackal hunting, or in the case of bites received in any way and at any time, my plan has always been to wash the wound freely at once, or as soon as possible, and then to burn it, not with solid nitrate of silver as is the usual practice, but with fuming acid nitric fort., or acid hydrochloric fort. Even in the case of bites from rabid dogs this plan has effectually prevented hydrophobia. It was the plan adopted in the case of my relative still living, referred to above as bitten twenty-four years ago by a rabid house dog.

On one occasion a dog obviously rabid "ran amuck" straight through my house biting everybody and every dog that came in his way. The dogs bitten were similarly treated, and none took hydrophobia.

I don't think the same trust can be placed in nitrate of silver, and for this reason. Let us suppose we are dealing with a deep bite from the long canine fang of a dog. What has happened? The tooth, a blunt instrument, has been driven by main force through the skin into the tissues, and, when so driven in, was coated with the poison-containing saliva, which was forced into the intercellular spaces of the tissue penetrated by the tooth, and although some of it lies in the wound cavity or lines the edges of the wound cavity inside, some or most of it has been jammed into the intercellular spaces around that cavity, and lies deeper in, in the tissues. The wound cavity in the meantime is filled with, and its sides wetted with, serum containing albumen. The nitrate of silver stick now penetrates into the wound cavity, reaches the saliva and serum lining its sides, kills the lining cells, and coagulates all the albumen within reach. The albumen film thus formed, forms, I submit, a protecting film which only protects the deeper-lying saliva and its poison; and in a deep penetrating bite shoving in a stick of nitrate of silver hard is very much like repeating the bite, and serves to drive the deeper-lying saliva only deeper still into the tissues, and so to place it farther outside, and hence better protected by the albumen-coagulum film, formed in the wound by the nitrate of silver treatment. If no albumen were coagulated in the wound the caustic would or might reach the farthest off and most deeply-lying saliva. But as nitrate of silver forms an albumen-coagulum, why not use an equally strong caustic which forms no coagulum? Hence the use of the fuming acid, which dissolves all albumen it reaches, and penetrates at once without the use of force into all the surrounding tissue spaces. The same holds good of all kinds of bites, and the penetrating acid kills all it reaches. One or two drops suffice for each bite, and the slough soon separates, and the clean wound then left heals readily. I have treated a great many bites in this way, and when my own dogs have gone mad I have invariably found that they had been bitten while I was away from home for some few days on some inspection duty.

Holding the views I have above indicated, I have always strongly objected to cauterising any bites with nitrate of silver, and have invariably advocated the use of strong acid. But whatever the immediate treatment it must be prompt. Otherwise, though a domestic animal may be kept under observation, for the human subject there is nothing for it but a visit to a Pasteur Institute, and the sooner India has one the better. How much does humanity owe to the beneficent genius of Louis Pasteur!

SOME OBSERVATIONS ON ENTERITIS IN THE HORSE.

By JOHN PENBERTHY, F.R.C.V.S., Royal Veterinary College, London.

TO the practitioner of Veterinary Medicine, abnormalities associated with the bowels of the horse, which afford a considerable proportion of his cases, are matters of great importance. Occurrences of recent years have emphasised what must have been evident to any enquiring mind, that much has to be learned and much to be unlearned as to the nature and deferential diagnosis of bowel affections, before satisfactory application can be made of the means of prevention and relief which, with the power to deferentiate the several conditions during life, would be at our disposal. In order to facilitate diagnosis and to suggest rational measures of treatment, a proper appreciation of the causes of such conditions is essential, and though much information may be gathered from theoretical reasoning as to the effect of the action of the causal factor, the accumulated results of clinical experience and *post-mortem* examination cannot fail to be of great value. It is with the view of adding the outcome of one individual's experience and thought to the weight of evidence that the following remarks are made.

A review of our veterinary literature on the subject of enteritis or inflammation of the bowels will show that there is there little agreement as to the condition to which the term is applied. Percival[1] says, "Enteritis consists in an inflammation of the middle or muscular coat, that which forms the principal substance of the gut."

Williams'[2], referring to this definition says, "It is evidently a mistake. Of course when such extreme congestion of the mucous membrane exists, all the coats are more or less implicated, but the primary and gravest condition is limited to the mucous membrane."

Youatt[3] speaks of two varieties, one affecting the external coat (peritoneum), and another, usually the result of an overdose of physic, affecting the internal or mucous coat.

Robertson[4] defines enteritis as "inflammation of the bowels generally or any portion of them."

Friedberger and Fröhner[5] describe the affection under the head of "Gastro-entérite," and "Catarrh, Gastro-intestinal."

Captain Fred. Smith[6] says, "Pure uncomplicated enteritis is inflammation of the mucous membrane of the intestines and of the mucous lining only."

Of late years, owing to differentiation of affections under the head of typhlitis, colitis, etc., there has been a tendency to limit the term enteritis to inflammation of the small intestines. Though it would appear to be most commonly applied by veterinary surgeons in the present day to deep-seated inflammations, it is obvious from the origin of the word that it would be unwise to restrict its meaning to inflammation of any special coat or locality of the intestine. It is

1 "Hippopathology," Part II., Vol. II., p. 32.
2 "Principles and Practice of Veterinary Medicine," 4th Edition, p. 669. 3 "The Horse," p. 207.
4 "Equine Medicine," 2nd Edition, p. 648. 5 "Pathology and Therapeutics," etc.
6 Proceedings, National Veterinary Association, 1887, p. 89.

well recognised that mucous membranes in any part of the body may be inflamed without appreciable change in adjacent structures, and that the observable effects of the causal factor may be limited to the superficial parts and the discharge from its surface, or that deeper parts of the mucous membrane may be affected and infiltrated with inflammatory products which do not find their way to the surface. Both these conditions properly come under the head of *muco-enteritis*, and the former is frequently spoken of as *enteric catarrh* or *catarrhal enteritis*. When the deeper structures of the intestinal mucous membrane or the middle coat of the bowel are affected, the term *phlegmonous enteritis* is often applied to the disease.

The intestines of the horse are undoubtedly liable to varieties of inflammation as to the parts affected, the severity, and the duration. Perusual of the literature of the subject, however, cannot fail to show that there has been, and to some extent is at present, in existence, the impression that *enteritis* of the horse affects the whole of the coats and is a rapidly fatal affection. In his veterinary medicine Williams'[1] says "Enteritis or inflammation of the bowels may safely be stated to be the most rapidly fatal disease to which the horse is liable, destroying life in course of a few hours;" and, further on, "It is doubtful if the condition usually regarded as inflammation of the bowels is other than apoplexy." Percival[2] observes that enteritis is often fatal in from twelve to twenty-four hours.

The further description of inflammation of the bowels by these and other writers conveys to me, at least, the idea that the conditions referred to most commonly are, properly speaking, not enteritis, but twist, or strangulation of vessels brought about in other ways. From my own experience and analysis of the recorded observations of others I am disposed to the view that rapidly fatal cases of enteritis, in which the whole substance of the wall of the gut is implicated, are by no means common, indeed are of comparatively rare occurrence. By this it is not intended to convey the idea that such a circumstance may not occur, for we recognise it in such affections as intestinal anthrax and others. There can, however, be little room for disputing the assertion, that the vast majority of cases of inflammation of the bowels or enteritis commence in the mucous membrane, are limited to it, and terminate fatally.

Concerning the causes which produce inflammation of the bowels, the views very commonly expressed appear to me to be at variance with the facts. We find most prominently mentioned, "Over-fatigue,[3] cold from exposure or from washing with very cold water whilst the animal is heated and then after inadequately clothed." "Colic,[4] constipation, hardened fæces, indigestible food, strangulation, intussusception, over-fatigue, cold, exposure." Youatt, refers to "sudden exposure to cold; or washing, after being heated, with cold water; being drenched with rain; stones; overdose of physic." Friedberger and Fröhner[5] enumerate "Cooling down, cold foods, violent work, irritating foods and drinks, drugs, large quantities of food, epizöotics, great heat, and low atmospheric pressure." Robertson[6] brings forward "Indigestion, colic, feeding, especially after exhaustion, often no sufficient cause observable, parasites."

1 Williams' *loc. cit.* 2 Percival, *loc. cit.* 3 Williams', *loc. cit.* 4 Percival, *loc. cit.* 5 Friedberger and Fröhner, *loc. cit.* 6 Robertson, *loc. cit.*

It will be observed that exposure to cold in different ways is most commonly accepted as a cause of enteritis. Without desiring to imply that, in rare instances in susceptible animals, cold may not predispose to the affection, I would state that I have never observed or been able to gather any evidence of enteritis thus produced.

It is not easy on theoretical grounds to escape the conviction that muco-enteritis is the result of direct irritation of the intestinal mucous membrane, and that although, as in the case of some well-known poisons, the irritant may be carried independent of its port of entrance into the system by the blood-stream, the point of attack is most commonly the surface of the membrane. Of the irritants credited with being most frequently in action are—undigested food, poisons, calculi, hard fæces, bacteria and their products, and helminths (worms).

Among the predisposing causes deficiency of bile is thought by some observers important, as favouring decomposition, bacterial activity, accumulation, and colic.

Analysis of the record of 120 cases of enteritis of the horse coming under my own notice, shows that eighty-eight were due to the irritation of worms; five to concretions or intussusception; seven proved or suspected irritant poison; nine, anthrax; three, tuberculosis; eight, cause not recognised. In the major portion of these cases the large intestine was the seat of inflammation. I think it will be generally conceded that enteritis in the horse is most generally found in the cæcum or colon. It is remarkable that these viscera are the natural habitats of the intestinal parasites known to be most injurious, and, I fear, in many neighbourhoods very profusely distributed.

The fact of having paid some special attention to intestinal helminthiasis may possibly have had the effect of bringing an undue share of such cases under my observation, but, adding the experience of several other observers, I am inclined to the view that by far the most common cause of enteritis of the horse is the intestinal parasite.

Reference to such an important work as Neumann's "Parasites and Parasitic Diseases," with the addition of editorial notes by Dr Fleming, however, does not produce on my mind the impression that the intestinal worms of the horse are commonly the cause of serious results. *Tænia perfoliata*, the commonest tapeworm, we are told, "generally remains unperceived during life, though sometimes it coincides with the general symtoms of intestinal helminthiasis. *Ascaris megalocephala* does not usually affect the health of the host, though in young animals they may give rise to various troubles in digestion." Referring to *Sclerostoma equinum* (Strongylus armatus) we find, "notwithstanding their sometimes considerable numbers and the irritation they should produce in the mucous membrane, their presence in the horse is rarely betrayed by any appreciable symptom; they have sometimes been accused of causing death by anæmia, diarrhœa, colic, etc." And, writing of the Sclerostoma tetracanthus, "they are generally considered inoffensive, but some observations show that by their great numbers they may be capable of producing a hæmorrhagic enteritis and fatal colics."

I think it necessary to draw special attention to the foregoing, as the work is the most important in our literature, and thus likely to

create a widespread impression of the slight importance of a class of irritants which, according to my own observations, are of the utmost significance.

The enteritis induced by the intestinal worms is by no means confined to horses in the country, four fatal cases have come within my own notice among our College infirmary patients during the present month.

While it is not desired to deny that other causes besides worms may be in action, I am convinced that these frequently escape observation. It is important to remember that a few intestinal worms may be observed unassociated with inflammatory change or without giving rise to symptoms. It is equally necessary to remember that when the sclerostomes are the cause of enteritis close observation and sometimes considerable magnification are necessary to detect their presence, even when they exist in myriads and are really most dangerous.

The effect of parasites in damaging the intestinal mucous membrane and thereby providing the means of entry of bacteria and other irritants, must not be lost sight of, and though the topical irritation of large numbers of worms usually first induces intestinal catarrh and its symptoms, and afterwards phlegmonous and fatal enteritis, a few worms may induce no evidence of catarrh, but allow inflammation-producing matters to enter and set up phlegmonous inflammation and other morbid states primarily.

Of the parasites inducing intestinal inflammation in the horse, the more common are the *Strongylus tetracanthus*, *Strongylus armatus*, *Ascaris megalocephala*, and *Tænia perfoliata*. The first named is by far most frequently observed, and to my mind the cause of the majority of cases of verminous enteritis. These worms, in their full grown state, are usually from half to two-thirds of an inch long, sometimes white or whitish grey, at others blood-red coloured. They may be found curled up in the substance of or underneath the mucous membrane which they have penetrated, and many feet of the walls of the colon or cæcum may be infested with them in varying degrees. By holding the intestine between the light and the eye these are readily observed, and I have counted as many as sixty in a superficial inch. Adult worms may also be seen holding on by their cephalic extremities to the mucous membrane, their bodies being in the lumen of the intestine. In some cases the worms are so numerous in this position as to convey the idea of dark red velvet-pile. They may too be found of microscopic size, in myriads, on the surface of the membrane, and it is probable that in this state their presence has very often not been suspected or realised. Strongylus armatus, the well-known palisade worm, I have never found alone producing serious inflammation of the intestines, though frequently I have observed it in conjunction with the foregoing. The cruel armature of the cephalic extremity of the adult palisade worm certainly is suggestive of great capability for injuring any structure attacked by it, and, without having been able to differentiate the two parasites in the minute immature state, I am disposed to the view that some of the small worms observed in scrapings of the surface of the mucous membrane may be of each variety. The Tænia perfoliata I have most commonly seen in large numbers, causing enteritis in the

cæcum. In some instances coming under my notice 3 or 4 gallons of these tapeworms have been found in the cæcum and colon. The Ascaris megalocephala is found in similar situations, and probably only gives rise to inflammation when in very large numbers.

Among the symptoms mentioned by Percival, as indicative of enteritis, are, "pawing, striking ground, striking belly, cringing his body, makes feints to lie down; lies down, rolls, and perhaps upon his back; rises again, casts a dolorous look at his flank, pants and blows, and sweats from pain. His belly is tense and painful to pressure, towards the flanks drawn up, and nothing is voided, save a few hard angular, dark-coloured dung balls, and they commonly at the commencement of the attack." The whole of the symptoms are continuous. "The continuance of his torturing pains drives the animal to a state not merely of extreme restlessness, but of real distress; he is either pawing, or repeatedly lying down and rising again; or else he is walking around his box, breathing hard, sighing, and, perhaps, occasionally snorting, etc." The last stage borders on delirium, which is vividly delineated.

Youatt's account is very similar, and Williams' substantially the same, particularly as to the violence of the symptoms, and the alteration which takes place when gangrene, which may result in eight or ten hours, has set in. Reference to the pathological conditions associated with the affections as described under the head of "Enteritis," I think, support the view that cases of volvulus have been included. Witness the following quotations:—

[1] "The small intestines, in particular the ileum and jejunum, are the common seats of the inflammation when it has arisen without obstruction, or has followed spasm.

"The affected parts exhibit various patchy shades of redness, from the pink or scarlet to the purple and even black hue, the last indicating that the part has mortified. This portion of the gut commonly contains air, and now and then when cut into exhibits masses of dark-coloured congealed blood. At the same time it is common to see effusion of water into the abdominal cavity.

"Mortification may ensue in eight or ten hours.

"[2] In the great majority of cases mortification results, or the animal dies from the debilitating effects of hæmorrhage into the intestinal canal. Gangrene may result in eight or ten hours."

The diagnosis of intestinal inflammation remains difficult, and in many cases unsatisfactory, while a study of the symptoms cannot very well be separated from a study of the etiology. Irritation of the intestinal mucous membranes is usually associated with pain and spasm, and if the irritant be constant in action the evidence of pain will probably be continuous. If the action of the cause be gradual and progressive the pain will likely be less acute and the spasm less severe. If the cause of the irritation come into operation suddenly the resulting spasm and pain will probably be more acute, and the symptoms of colic more severe. If the action of the cause be suspended there will probably be a remission of the more marked symptoms of spasm and pain. There are, however, many circumstances which may modify these physiological effects, and no definite rules

1 Percival, "Hippopathology," *loc. cit.*
2 Williams' "Principles and Practice of Veterinary Medicine."

exist on which we may build up a positive diagnosis of the cause. Individual temperament is responsible for varied manifestation of the same sensory states, while conditions giving rise to tympany and its effects, which may or may not be associated with enteritis arising from any cause, cannot be determined. Symptoms, too, will be modified by the extent and severity of the inflammation. If the irritation be confined to the superficial parts of extensive areas of the mucous membrane, diarrhœa and debility will probably be prominent features, and the evidence of abdominal pain less marked. If the deeper structures be affected suppression of fæces is commonly noticed, while symptoms of intense continued pain and consequent exhaustion are evident. If large areas of the highly vascular intestinal membrane be gorged with blood the temperature of the external parts of the body will probably be low, the pulse small, and the urine suppressed, and containing some matters usually disposed of by the intestines, and which tend to render its reaction acid. With these must be considered the effect of limited or extensive inflammation, and its intensity, etc., on the temperature, the effects of inflammatory products, abdominal pain, etc., on the several parts of the system, and complications, such as rupture of the intestinal walls, etc.

It is not pretended for this article that it is exhaustive, and space will not permit reference to the symptoms which are associated with each of the several causes before-mentioned as giving rise to the 120 cases. I hope to refer to these in a future contribution on the subject. As, however, nearly three-quarters of these cases were caused by strongyles, it may be permitted to remark here that I have observed that in young animals the irritation appears in many cases to act for a long time on the superficial parts of the membrane, and to induce intestinal catarrh and diarrhœa, which often persist for weeks and months, and are accompanied by the dependent debility, emaciation, and anæmia. In older horses these symptoms are often not at all prominent. The effect of the parasite, however, is usually gradual, and the rule, in my experience, has been that violent evidence of abdominal pain has been absent. The following case is somewhat typical, though the temperature was perhaps a little lower than usual so near the end.

The subject, a roan mare, seven years old, was admitted to the infirmary on 11th February 1896. The history was that she had been noticed to be rather dull and weak for some weeks, but had worked up to within a few days of her admission, when the dulness became more marked, appetite was lost, there was diarrhœa, and occasionally evidence of light colicky pain. On being examined, temperature was 101·4°, pulse 40, respirations 10, mucous membranes yellow, great dulness, extremities cold, food refused. The animal was warmly rugged and bandaged, and received 2 ounces of tincture of opium.

12th February. Temperature 102·6°, pulse 36, respirations 9, no fæces passed, no evidence of pain, visible mucous membranes yellow, food refused. Four ounces of sulphate of magnesia administered.

13th February. Temperature 101·8°, pulse 38, respirations 11, no fæces passed. Animal lies down, and manifests abdominal pain by looking to flanks. Half-ounce doses of chlorodyne given five times during the day.

14th February. Temperature 103°, pulse 40, respirations 10, small

quantity of soft fæces passed. Same evidence of abdominal pain continued. Conjunctival mucous membranes injected. Chlorodyne as before.

15th February. Temperature 101°, pulse 46, respirations 12. Animal frequently lies down and rises, evidence of rather more severe, though not violent, pain; small quantity of fæces passed. Chlorodyne continued, and morphia injected subcutaneously.

16th February. Temperature 102°, pulse 48, respirations 18. Condition same as on 15th. Treatment repeated.

17th February. Temperature 103°, pulse 89, respirations 24. Evidence of abdominal pain more marked but not violent; some tenesmus; vessels of conjunction intensely congested. Seven grains of morphia subcutaneously three times.

18th February. Temperature 102·6°, pulse 99, respirations 24. Depression very marked, heart-beats feeble, no fæces passed, a small quantity of thick urine, tenesmus, and evidence of abdominal pain, less marked towards evening. Treatment continued.

19th February. Died early in the morning.

The autopsy revealed intense muco-enteritis of large areas of the cæcum and colon. Other visceras healthy. Myriads of minute strongyles on the inflamed mucous membrane. No parasites were noticed before death, as frequently may be done in the fæces or on the arm after rectal exploration.

INTESTINAL PSOROSPERMOSIS IN LAMBS.

By J. M'FADYEAN, Royal Veterinary College, London.

THE term psorospermosis is applied to diseased conditions caused by the so-called psorosperms, which are animal parasites, most of them microscopic in size, and all of them comparatively simple in structure. The best known of these parasites is the coccidium oviforme, which is parasitic in the bile ducts of the rabbit—wild and domesticated, and which is a not infrequent cause of serious mortality in that species. In a former article[1] I described this parasite, and the lesions which are set up by its presence in the rabbit's liver; and at the same time I recorded some observations that I had made regarding an identical or nearly related coccidium which was responsible for a very heavy mortality in young pheasants. The pheasant coccidia inhabited the intestinal epithelium, which, in consequence of their presence, was in a large measure destroyed.

Since the above-mentioned article was published, I have discovered the same parasite in other outbreaks of disease, both among young pheasants and adult domestic fowls; but the object of the present note is not to record any new observations made regarding this avian psorospermosis, but to describe a recently encountered form of this disease, which is of greater interest owing to the species attacked, and the nature of the lesions excited.

In the month of April last, in making a *post-mortem* examination of a lamb which had been forwarded to me after death for that purpose, I discovered in the small intestine a considerable number of reddish

[1] Vol. VII., p. 131, of this Journal.

pear-shaped tumour-like bodies, mostly about two or three times the size of an oat seed, and sessile on the mucous membrane. Apart from the presence of these growths, the lining membrane of the bowel was at some places the seat of a diffuse inflammation, attended with marked injection of the small vessels of the villi. When the fluid obtained by squeezing one of the tumours was examined under the microscope it showed large numbers of oval coccidia, similar to the coccidium oviforme of the rabbit, but distinctly smaller.

A few days after the before-described case was examined I paid a visit to the farm on which the lamb had died, and I was fortunate enough to find there another member of the flock in a moribund condition, from what was regarded by the shepherd as the same disease. This lamb was killed and submitted to *post-mortem* examination, with exactly the same result as in the first case.

On microscopic examination the small tumours of the bowel are found to have a very interesting structure. They appear to have been produced by an irregular hyperplasia of the mucous membrane, including both the villi and the glandular stratum. The former are enlarged and somewhat distorted from an overgrowth of their central adenoid tissue and surface epithelium, but at some places, especially towards their tips, they are quite denuded of their epithelial covering. The bulk of each tumour, however, is seen to be made up of the altered glandular layer of the bowel wall, in which the crypts of Lieberkühn show an appearance that strongly recalls an adenomatous growth. The single layer of columnar cells which forms the normal lining of these glands is for the most part represented by a stratified epithelium, in which at some places as many as ten or more strata of close nuclei may be counted. At a few places, as in the case of the villi, the epithelium is entirely destroyed. The adenomatous type of structure is due to the fact that many of the glands show irregular lateral diverticula, lined like the parent gland with an abnormally thick epithelium. Between the irregularly overgrown glands the adenoid tissue appears to be increased in amount, though not notably altered in structure.

All of these points are readily observed on inspection of a well-prepared section with a low power, and even with a low magnification one can detect here and there in the epithelium of the glands or villi the larger coccidia, while with higher magnification immense numbers of the smaller parasites are brought into view.

The smallest coccidia are present in large numbers in the proliferated epithelium of the villi and the glands of Lieberkühn. In both positions they are most abundant in the surface layer of columnar cells, and the majority of them occupy the outer part of the cell body. In the normal epithelium the nuclei are situated towards the deep ends of the cells, but in the epithelium invaded by the young coccidia the outer half of each cell appears to be dotted with minute nuclei. When sufficiently magnified, these are found to belong to the smaller coccidia, which have a diameter of about 2·7 μ, while their nuclei measure about 1·7 μ. The cell substance of these small coccidia is clear, unstained (in alum-carmine), and homogeneous even under a high magnification.

A point of very great interest in connection with these small bodies is that very many of their nuclei present an appearance which is

strongly suggestive of division. In a considerable proportion of them two nuclei are present separated by a narrow clear line, as if the nucleus had just divided into two. Such figures have a close resemblance to the diplococcus form of dividing micrococci.

Coccidia a little larger than these apparently youngest forms have more cell-substance, and with further growth the central spherical nucleus (which stains well with alum-carmine) comes to be surrounded by a narrow halo-like zone, while the cell-substance becomes filled with minute granules. These "gregaina granules" become much coarser as the coccidium approaches its full size, and, as they stain with carmine, they generally completely mask the nucleus in the larger parasites. As the final developmental step observable in the intra-cellular parasites, they assume an oval shape and acquire a double-contoured cuticle or shell. Just before the latter makes its appearance the granules are often arranged with marked regularity at the surface of the cell-substance. The mature shelled coccidia have a long diameter of about $20\,\mu$, while their transverse measurement at their widest part is about $14\,\mu$. Save in point of size they differ in no way from the coccidium oviforme of the rabbit's liver, or the variety which I have previously described from the intestine of the pheasant. No cultivation experiments were attempted and I am therefore unable to say anything regarding their subsequent transformations. Probably, their contents, as in the case of the rabbit coccidia, at a later stage (either in the intestine or external to the body) become transformed into spores, which, when they gain access to the body of a new host assume an amœboid form and start a fresh cycle of development. But on *a priori* grounds, as well as on account of the signs of nuclear division already referred to, it may fairly be assumed that an actual multiplication of the parasites does go on within the body of the host. In the first place it is wholly incredible that every individual coccidium found in the intestinal epithelium can have been ingested by the host, for on such an assumption it would be quite impossible to explain why great numbers of young coccidia are found side by side in the same gland, while other glands only a short distance removed are quite free from parasites. In whatever way the spores or young coccidia gain access to the alimentary canal, one must imagine that they have a fairly uniform distribution in the alimentary matters by the time that they reach the small intestine, and therefore one would expect to find a tolerably uniform invasion of the epithelium; and, assuming, that large numbers of parasites are ingested on successive occasions one would also expect to find coccidia in all stages of development side by side. Instead of that, however, the invasion of the epithelium is by no means regular in its distribution; and, while one does find here and there both young and mature forms near one another, that is the exception rather than the rule. On these grounds it appears much more probable that, just as with bacterial diseases, infection is generally by means of a small number of individuals, and that these multiply either while free in the bowel or after they have invaded the epithelium. When one reflects that in even the most favourable circumstances only a very small proportion of the coccidia which are passed out with the excreta are likely to find their way into the body of a new host, and that only a small number of the so-called spores (four to eight) are formed in a single coccidium, it seems quite impossible to

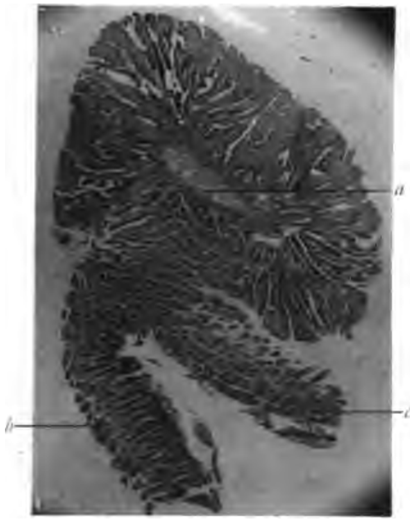
account for the continuance of the species without conceding the power of direct multiplication to all the individual coccidia.

As already mentioned, the small pyriform tumours were not the only lesion present in the bowel, for the mucous membrane showed more or less inflammatory congestion, and on microscopic examination it is found that many of the villi not involved in the tumour-like formations are absolutely denuded of their epithelium and show extreme distension of their capillaries with blood. It is indeed probable that this alteration, to a much greater extent than the development of the small tumours, was responsible for the diarrhœa from which the lambs suffered at the end, and for the fatal termination of the disease. The lambs, it may be observed, were from two to three months old, and in a period of about one month there had been a mortality of nearly 10 per cent.

Death usually resulted within forty-eight hours after the onset of the symptoms, which were dulness, loss of appetite, diarrhœa, and tympanitic distension of the abdomen. The lambs at the time when the disease broke out in the flock were closely folded together with the ewes on growing roots, which, needless to say, were much soiled with earth and fæces before they were completely consumed. Assuming that the coccidia passed out with the excreta are capable of infecting other individuals, one can hardly imagine circumstances more favourable for the spread of the disease than those which were in existence in this flock. The disease appeared to attack the lambs the ewes seemingly being able to resist infection.

So far as I am aware, this is the first instance in which intestinal psorospermosis has been observed in sheep in this country, and I know of only one similar observation abroad, viz., by Professor Nocard, who contributed a note on the subject to the Seventh International Congress of Hygiene and Demography. This note was afterwards published, together with an illustration, in the Journal of Pathology and Bacteriology (Vol. I., p. 404). The mature coccidia are there described as being only 10 to 12 μ in their long diameter, whereas in the cases here recorded they were nearly double that size. Professor Nocard was inclined to regard the coarse granules which appear in the cell-substance of the larger coccidia as spores, and on that account, and because of their smaller size, he concluded that the ovine coccidia do not belong to the same family as the coccidium oviforme of the rabbit. But in my preparations the full-grown coccidia have a long diameter nearly double that given by Professor Nocard, and whatever may be the nature and purpose of the "granules" they can hardly be regarded as spores, inasmuch as their formation is certainly not preceded by division of the central nucleus. It is true that in most cases the nucleus is no longer discernible in the coccidia with large coarse granules, but probably that is because these granules mask its presence, for with a careful search one finds here and there a coccidium in which the central but now faintly stained nucleus can be made out although the large round granules are present in the cell substance. Moreover, the formation of these granules can hardly be regarded as sufficient ground for placing the ovine coccidia in a different family from the coccidium oviforme, for similar though considerably smaller granules make their appearance in the rabbits coccidia before they acquire the shell.

1



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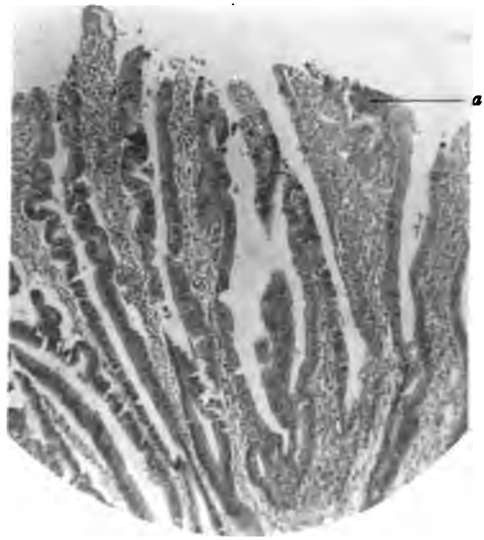

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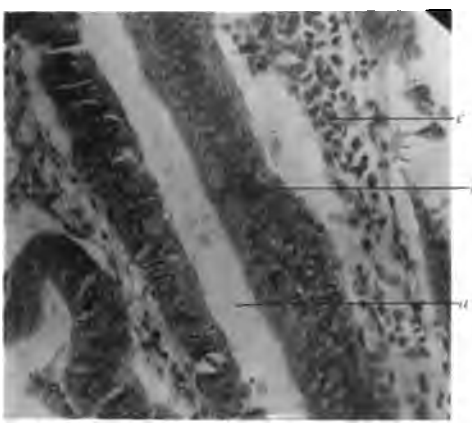

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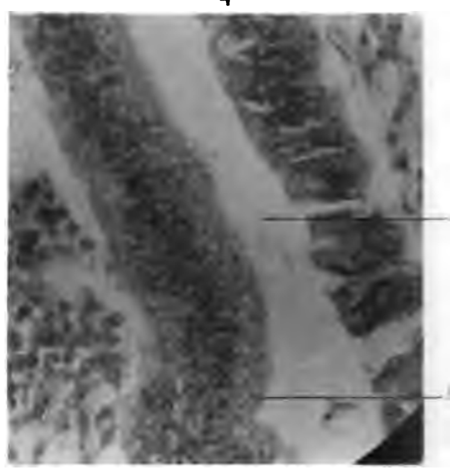

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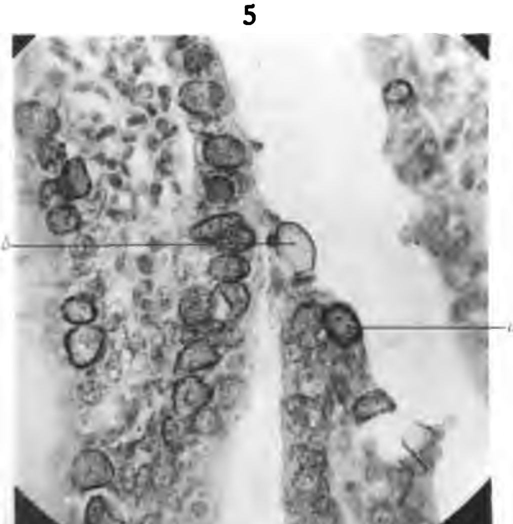

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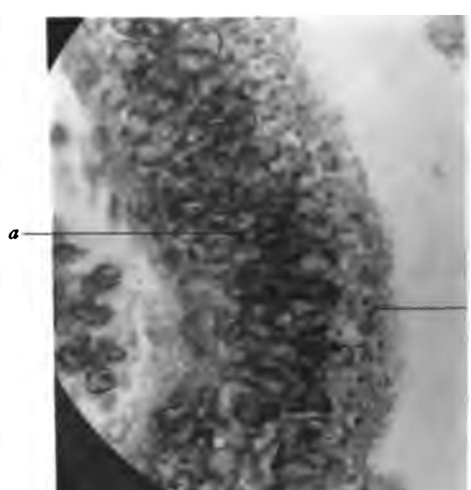

DESCRIPTION OF PLATE I.

Fig. 1. Psorosperm tumours of lamb's intestine (× 9); *a*, the centre of the tumour, representing the submucous coat; *b*, mucous membrane of the wall of the small intestine cut vertically; *c*, the same cut obliquely.

Fig. 2. Portion of the same tumour (× 58); *a*, a group of mature shelled coccidia. Smaller groups of coccidia are visible at several other places in the epithelium.

Fig. 3. Portion of a gland of Lieberkühn (× 250); *a*, lumen of the gland; *b*, epithelium with numerous small nucleated coccidia in its superficial stratum; *c*, interglandular adenoid tissue.

Fig. 4. Portion of another gland (× 370); *a* and *b*, as in preceding figure.

Fig. 5. Portions of villi at surface of tumour (× 370); *a*, a nearly mature coccidium, showing some granules in its interior, and others arranged as a ring at its surface; *b*, a mature shelled coccidium. Numerous other coccidia in various stages of development are seen in the epithelium or replacing it.

Fig. 6. Epithelial lining of an invaded gland (× 714); *a*, proliferated nuclei of the epithelium; *b*, superficial part of the epithelium invaded by young nucleated coccidia.

EDITORIAL ARTICLES.

THE STAMPING OUT OF GLANDERS.

WE have on several occasions in these columns dealt with this subject, but we do not think that we owe any apology to our readers for again returning to it. Judging by the small impression that has been made on the disease during the last twelve months, it seems only too plain that the measures now being enforced stand in need of some alteration. The extermination of the disease, even in London and other large centres, is no longer an impossible task, and if it is not effected within the next few years a great reproach will lie with the veterinary profession for not having urged the adoption of regulations adequate to the end in view, or with Local Authorities for not having adopted the counsel offered them.

Let us see, in the first place, what is now being done in London (which furnishes 70 per cent. of all the cases of glanders reported during the year) with the object of eradicating or checking the disease. When an inspector to the Local Authority discovers or has brought to his notice a horse which is, in his opinion, the subject of glanders or farcy, that horse is slaughtered, and the carcase is so dealt with as to render it innocuous, while in compensation for the destruction of the carcase the owner is allowed £2. The stall or loose-box in which the horse has been standing before his slaughter is cleansed and disinfected. If there are other horses in the same stable these are examined by the veterinary inspector, but, provided that no lesion commonly accepted as indicative of glanders is detected in any

of them, no restriction is placed on their movements, and in the eye of the law they are regarded as free from glanders as soon as their visibly glandered companion has been slaughtered.

When the inspector discovers or has brought to his notice a horse presenting symptoms that are indicative of glanders, but not sufficient, in his opinion, to justify a positive diagnosis, the animal is labelled "suspected of glanders." By this act of labelling it is rendered illegal for the owner to move the horse in question out of the premises in which he is then standing for any other purpose than slaughter. Unless in the interval the horse is destroyed by or with the consent of the owner, this embargo remains in force until the progress of the case warrants the inspector either in declaring the horse glandered or in removing the label.

Such are the regulations now in force, and experience of their working warrants the belief that they are inadequate if the end in view is the stamping out of the disease. Regarding the exact point in which they are defective opinion is divided. Some --and there are grounds for thinking the majority—of the veterinary profession in London are strongly of opinion that the great defect in the regulations is the withholding of compensation for the slaughter of glandered animals—we say withholding, for the £2 granted is viewed as compensation for the destruction of the carcase, not for the value of the living animal. Those who hold this opinion maintain that, owing to reasonable compensation being withheld, concealment of diseased or suspected horses is largely practised, and that this in chief measure accounts for the persistence of the disease in London. Conversely, they urge that if horse-owners were offered reasonable compensation—say, one-fourth of the value of the horse before he was attacked—the existence of the disease would generally be promptly notified, and a fertile source of infection would thereby be removed.

We have said that there are grounds for thinking that this is the current view among veterinary surgeons practising in London, for a few months since, at a meeting of metropolitan practitioners specially convened to consider the question, it was unanimously resolved to urge upon the London County Council the desirability of allowing more liberal compensation for horses destroyed as glandered. But with all due deference to the experience and authority of those who take this view of the matter, we submit that the withholding of compensation for horses destroyed when clinically glandered is not the main defect in the existing regulations, if it is a defect at all. Supposing that the London County Council were to take the course urged upon them, and agree to compensate to the extent of one-fourth of the value of the horse when sound, would that secure the early eradication of the disease? Certainly not. The proof that it would fail is furnished by the fact that many large and wealthy horse-owning companies have still glanders in their stables, although for

years they have rigorously isolated every horse presenting the slightest suspicion of glanders, and promptly slaughtered every horse with well-developed symptoms of the disease. The disease is not mainly perpetuated or spread by failure to notify, or by keeping alive horses that are known by their owners to be glandered, but by inability to detect glanders in its early stages, and by traffic in glandered horses that appear healthy.

No doubt the granting of compensation for horses slaughtered when glandered would be very popular with horse-owners, and would be a means of mitigating, at the public expense, the dead loss which at present falls upon those who are so unfortunate as to possess horses visibly affected with the disease, but it is very doubtful whether it would contribute in any degree to the suppression of glanders, and it certainly cannot be claimed as a right. The market value of a visibly glandered horse is less than nothing, though it is quite true that he may not be valueless as regards his power for work. But his value in the latter respect is nullified by the fact that the public have a right to demand that the working of him shall not involve the risk of spreading the disease to the healthy horses of other owners. No new principle is enunciated in this statement. It is no crime to be the subject of small-pox or typhus, but a patient suffering from either of these diseases is not at liberty to follow his ordinary avocations to the risk of other people, and the law does not award him any compensation for this prohibition. In like manner a milkman suffering from scarlatina is an object of compassion, but he cannot claim compensation because in the public interest he is compelled to abstain from work while so affected.

The great defect in the existing methods of dealing with glanders is the non-recognition of mallein, which is absolutely the only means whereby in any outbreak of glanders it is possible to ascertain how many horses are really affected. Everyone knows that when a case of glanders is discovered in a stable of, say, ten horses, the chances are one hundred to one that some of the apparently healthy horses are already affected, and if eradication is aimed at it is the most transparent foolishness to consider the stable free from the disease because the visibly glandered horse has been slaughtered. And if it is justifiable to compel the isolation of a horse that is suspected of glanders on account of a thick leg or an enlarged submaxillary gland, it is also justifiable to place restrictions on horses that are known to have cohabited with a case of glanders; indeed, one may go further, and say that to omit to do this is to neglect a precaution absolutely necessary in the public interest. Everyone is ready to admit the necessity for such restrictions in the case of pleuro-pneumonia and swine-fever, and why not in the case of glanders? At one time the omission of this precaution could be justified on the ground that there was no means of ascertaining which of the in-contact horses were

really affected, and that slaughter of both diseased and suspected could not be faced on account of the expense. But all that has been changed by the discovery of mallein.

It is a noteworthy circumstance that at a recent meeting of the Central Veterinary Medical Society Mr Hunting declared his belief that the mallein test is "almost infallible," and not a dissentient voice was raised against this estimate of its value. It is just as certain that on healthy horses the test is a harmless one, and the owner who objects to its use can have no other ground for his action than a desire to conceal the extent of the disease in his stud.

If the London County Council desires to stamp out glanders within the next few years it must make up its mind to regard every horse in a glandered stable as suspected, and to insist upon the adoption of the mallein test in every outbreak. If its use cannot be enforced under the law as it at present stands, then the law ought to be amended. But if the disease is to be attacked in this thorough way, and if every horse that reacts is to be slaughtered, then compensation must follow. There is nothing inconsistent in making this demand. We object to granting any compensation for the destruction of clinically glandered horses while in-contact horses are allowed to go free, because that is simply a process of frittering away the public money, which might be carried on for a century without stamping out the disease. On the other hand, we are not opposed to moderate compensation combined with the compulsory use of mallein, because that would be a certain means of eradication, and the result would be something like commensurate with the cost. If horse-owners object to the compulsory use of mallein no sympathy will be due to them should Local Authorities seek powers (if they do not already possess them) to place restrictions on the movement of every horse that has been in the same stable with a glandered one.

At the present time, according to our reading of the Glanders or Farcy Order of 1894, Local Authorities cannot compel the isolation of horses simply on the ground that they have recently been in companionship with a glandered horse. Power is granted to make regulations "for prohibiting or regulating the movement into or out of any stable, building, field, or other place in which glanders or farcy exists; of any horse, ass, or mule which has been in the same stable, building, field, or other place, or otherwise in contact with any diseased or suspected horse, ass, or mule, or which has been otherwise exposed to the infection of glanders or farcy," but this power is restricted by the condition that any such regulation "shall operate so long only as any horse, ass, or mule, which in the judgment of the Local Authority is diseased, remains in the stable, building, field, or other place to which the regulation refers." It was probably intended by this that any restriction on the movement of in-contact horses must cease when every clinically glandered horse in the stable has been slaughtered.

At any rate this appears to be the way in which the Order is generally interpreted, and the effect is that in nearly every outbreak glandered horses are left on the premises, and the owner is at liberty to either work them or sell them. Moreover, the owner is at liberty to test his whole stock with mallein, and sell all those that react—that is to say, sell horses that are glandered. This is a scandalous defect in the law, and it is earnestly to be hoped that it will be remedied in the near future.

The fact is that the discovery of mallein has raised a number of questions for the settlement of which a new Order is urgently required. To take only one convincing illustration—the Order now in force requires the owner of every diseased (glandered) horse to give notice of the fact to the police, and veterinary surgeons who have used mallein in this country are unanimous in pronouncing it an almost infallible test; hence it would clearly appear to be the duty of the owner of any horse that has reacted to mallein to notify the fact. But at the present time such notice is practically never given, and for anything we know to the contrary it may not be the desire of the Board of Agriculture that it should. That, however, is not the question. We are merely pointing out that a reaction to mallein is as trustworthy an indication of glanders as any symptom or lesion observable during life, and that therefore, according to the letter of the existing Order, notification is necessary whenever a horse reacts to mallein.

It is true that a veterinary officer of the Board of Agriculture has expressed the opinion that reaction to mallein ought not to be regarded as sufficient by itself to condemn a horse as glandered, but that was at a time when mallein was still on its trial, and at any rate such an opinion would not over-ride the Order itself.

In another form this point has already actually been raised by the recent action of a veterinary inspector to the London County Council, who, when it came to his knowledge that a number of horses in a particular stable had reacted to mallein, promptly labelled them as suspected. According to the letter of the law the inspector in doing so certainly did not exceed the powers conferred upon him by the Glanders or Farcy Order, though we cannot help thinking that it would be unwise to adopt this as the general procedure at the present moment, since it could hardly have any other effect than to lead those who are honestly making use of mallein to abandon it. By an honest use of mallein we mean its employment to discover latent cases of glanders, not with the object of selling them, but in order to be able to arrest the spread of the disease, by separating the affected from the healthy while at work and in the stable. This voluntary use of mallein certainly ought to be encouraged by the Local Authority until the test receives official recognition, or until a special Order laying down the law for its employment is issued by the Board of Agriculture.

Reviews.

Annual Report of Proceedings under the Contagious Diseases (Animals) Acts, etc., for the year 1894. London: Eyre & Spottiswoode.

WITH an altered title this is the Annual Report of the Veterinary Department of the Board of Agriculture. It is issued nearly twelve months behind the time at which it might reasonably be expected to appear, and for this delay it is difficult to imagine a sufficient excuse. The first part of the Report comprises articles by the Chief Veterinary Officer regarding swine-fever, verrucose endocarditis in swine (swine erysipelas), pleuro-pneumonia, foot-and-mouth disease, rabies, anthrax, and glanders. Probably the most valuable of these articles is the one dealing with swine-fever, in which the lesions of that disease are described with a view to their differentiation from other morbid conditions likely to be confounded with them. The value of this description is greatly enhanced by a series of beautifully executed coloured plates, illustrating different types of swine-fever lesions in the stomach and intestines. These are among the most faithful representations of swine-fever lesions that have yet been published, and all those who have to do with the diagnosis of this disease as veterinary inspectors would do well to study them.

One of the most interesting statements contained in the Report of the Chief Veterinary Officer is contained in the article on verrucose endocarditis in swine. It is that no fewer than 270 examples of this lesion were discovered among the viscera of pigs sent to the Board during the year. The great interest of the statement lies in the fact that it indicates a wide distribution of the swine erysipelas bacillus in this country, and yet in the acute epizöotic form the disease appears to be comparatively rare.

In the article on glanders it is stated that "in mallein we have a material which if universally applied under professional superintendence in all infected stables would enable owners themselves to eradicate glanders from their studs."

The Report also contains an article by the "Principal of the Animal's Division" relating to the subjects dealt with by the Executive of the Animal's Division (Veterinary Department?) during the year.

Therapeutisches Jahrbuch der Thierheilkunde für 1895. Von Eugen Bass. Berlin: 1896. Richard Schoetz.

THIS is the second issue of what is intended to be an annual publication. The matter which it contains has been culled from the principal veterinary periodicals (thirty-five in number) published in Europe during 1895, and, as the title indicates, the abstracts have been made mainly from articles containing something new in relation to the treatment, medical or surgical, of the diseases of the domesticated animals. The articles are arranged in alphabetical order, and at the end there is a very copious index. The book comprises 159 pages, and its price is four marks. To those who can read German it may be recommended as well worth the money.

CLINICAL ARTICLES.

A CASE OF FISTULA OF THE PHARYNX.

By A. L. BUTTERS, M.R.C.V.S., London.

THE animal which suffered from this rather unusual affection of the throat was a five-year-old bay cart mare. My attention was directed to her in consequence of the attendant noticing that she coughed frequently and did not eat all her food. I then observed that there was a slight discharge from the nostrils and poking out of the nose, while the mouth felt hot and slimy and the pulse was accelerated. In the centre of the submaxillary space was a hard painful swelling. The cough was strong, hard, and frequent—in short, the symptoms were those of a rather acute case of strangles.

During the next four days the swelling in the throat increased in size, and showed evidence of pointing, and, as the difficulty of swallowing had increased, the abscess was lanced and about a table-spoonful of laudable pus evacuated. It was now hoped that the worst had passed, and that relief would soon be obtained. During the next two days the mare appeared slightly easier, but it was then seen that the throat on the near side was enlarged, as if another abscess were forming. The swelling was very hard and sore when pressed, and it was most prominent midway between the root of the ear and the angle of the inferior maxilla. For some days the swelling gradually increased, extending most downwards under the throat. Although daily examined no sign of softening or fluctuation could be felt. The difficulty in swallowing became daily more aggravated, and the breathing more noisy, and it was feared that tracheotomy would have to be performed. On the eleventh day a moist place was found at the most dependant part of the swelling, and closer examination showed that the skin had given way at this point, and that moisture was oozing from it. The opening was enlarged, and a small quantity of material which proved to be sour smelling well masticated food was extracted. So firmly was this food impacted in the abscess that a blunt probe and forceps had to be used to remove it. The amount taken out would fill a small teacup, and a cavity of nearly corresponding dimensions was left. The mare had become much emaciated, but from this time she slowly improved, the noisy breathing having ceased, and the cough and difficulty in swallowing gradually disappeared. The walls of the abscess did not collapse, but the cavity became less as the swelling of the surrounding parts subsided, and also partly by granulation, until there was only a very small aperture. No solid food was seen to come away from the wound, but the discharge was always tinged with the colour of it. This was most marked when eating green food.

The mare was discharged for work nine weeks after her admission to the infirmary, having regained flesh and condition. The existence of a sinus from the pharynx was now most readily seen when drinking at a trough, little jets of water then coming from it with each mouthful swallowed, to the surprise and amusement of everybody who saw it.

This continued for about two months, and then ceased, and nothing but a small cord can now be felt as the remains of the sinus.

Treatment.—During the time the difficulty of swallowing continued an electuary containing belladonna and chlorate of potash was put upon the tongue several times daily, while a hot sponge was kept at the throat by means of a hood. The wound in the throat was at first dressed with carbolic oil, and when the sinus had formed an injection of a solution of nitrate of silver was tried several times, but without any good effect; ultimately it healed without any treatment whatever.

In my experience this is a rare case. One gentleman who saw it stated he had seen several, while another practitioner to whom I mentioned it promised to show me an exactly similar case, the water coming out in small jets when drinking. I cannot therefore look upon the case as unique. Cases of sore throat and strangles are frequent enough, but why some few should terminate with a sinus in the pharynx is a problem I leave to others.

Never having read of any similar case is my excuse for recording this one.

ACTINOMYCOSIS IN A HORSE.[1]

By M. H. HAYES, F.R.C.V.S., Tarporley, Cheshire.

ACTINOMYCOSIS is a disease caused by the ray-fungus (*actinomyces*).

The only cases of actinomycosis which I have read of in the horse are: one in the skin and underlying tissues of the thigh, subsequent to a wound, reported by Perroncito; one in the tongue, by Zschokke; one in the tongue, by Truelsen; one, by Israel; and one, by Baracz.

In the horse, the only case I have seen which minutely resembled, as to symptoms and progress, those of well verified actinomycosis, was one of the tongue, in which careful examination failed to discover the parasite. I ascribe this failure to the fact that the only diseased parts of the tongue I submitted to microscopical investigation were the nodules which were shed out of the substance of the tongue, and which were subsequently proved to consist of fibrous tissue. There being little or no pus present, I did not collect for examination any of this discharge, which is essentially the abode of these fungi. In this case the tongue, on the first day that I saw the animal, was swollen to at least four times its normal thickness; was as hard to the touch as a piece of cartilage; and had lost all its power of motion, except a slight backward and forward movement. The end of the tongue had a mottled appearance, being covered partly with purple patches of congestion; partly with yellow patches. Further back, there were two deep grooves, one on each side, corresponding in size to the back teeth, which had evidently excavated them, during the backward and forward movements of the hard and greatly swollen tongue. Connecting the front portions of these grooves was a transverse furrow, which was so deep (at least 2 inches) that I had to be very careful in manipulating the free end of the tongue, lest I might detach it from the fixed portion. This transverse groove contained a comparatively

large quantity of hard yellow nodules of what was subsequently proved to be fibrous tissue. The exposed surfaces of the tongue were of a very dark red, almost black, colour, and showed no granulations or any other signs of the formation of pus. The horse, a handsome three-year-old throughbred entire, was able, with the greatest difficulty, to eat only a very small amount of grass; for he "quidded" by far the greater proportion of the grass which he took into his mouth. He was quite unable to eat hay or oats, and there was a constant and copious discharge of saliva from his lips. Consequently he was in terribly bad condition, and would evidently have starved to death in a few days. The tongue was extremely painful to the touch; apparently because the nerves of the part, on manipulation, became pressed against the hard fibrous nodules which were embedded in the tongue and which I shall allude to more fully further on. The mouth exhaled a stinking odour.

Friedberger and Fröhner observe that "when the tongue is affected, prehension and mastication are impeded. The organ is swollen and painful to the touch, and there is an abundant flow of saliva." These writers state that although the tumours (which may vary in size from that of a pin's head to that of a broad bean) are generally soft, they are sometimes of a fibrous consistency and greyish white; resembling, in fact, those of the case I treated. Crookshank states that the manifestations of actinomycosis in the tongue are "most commonly in the form of nodules or wart-like patches under the mucous membrane, with a special tendency to ulcerate from the irritation of the teeth." The characteristic hardness of the affected tongue, which has caused the disease to be referred to in various countries as "wooden tongue" (*Holzzunge* and *Langue de bois*), is due to inflammation of the substance of the tongue, set up by the presence of the fungus. The tumours, wherever they may appear, may be hard, as I have described, or soft, and may, like those of scirrhous cord, degenerate, with the formation of pus, in which the fungus may be found.

Treatment.—The treatment which I successfully adopted in my presumed case of actinomycosis in the horse was as follows. Learning that the animal had been getting ½ oz. of iodide of potassium daily, and seeing that that amount had wholly failed to check the course of the disease, I began by giving 2 oz. of that drug daily in the drinking water; and found after three days of this treatment that the tongue had decreased in size, was softer to the touch, and had lost its fœtid smell, while the patient was able to eat better. During the following thirty-eight days, I gave the animal 52 oz. of iodide of potassium, without producing any of the characteristic signs of iodine-irritation to the system, such as running at the eyes and nose, which are quickly apparent in man from an overdose of this medicine. The only untoward effect produced in this case by the immense doses which I was giving, and which I varied according to circumstances, was difficulty in staling. This complication was in no way serious, and soon passed off after the removal of its exciting cause. Every day, after having thrown the horse, I scraped with the finger nail all the exposed nodules I could reach, and applied to the wounds in the tongue, at different times, tincture of iodine and eucalyptus oil daily, and a solution of 20 grains of chloride of zinc to the ounce of

water, every second day. The last-mentioned application I found to be by far the most effective of the three. As long as the horse's tongue was so bad that he was unable to eat enough grass to sustain life, I gave him daily a dozen or more raw eggs. Under this treatment, the nodules which were in the free part of the tongue, and which had, in the first instance, manifested their presence in the substance of that organ only by yellow patches on its surface, gradually separated themselves from the surrounding tissue, and came away in the form of hard, granular nodules, which looked like pieces of greyish-white or yellowish-white coral, and which varied in size, as I have already said, from that of a pin's head to that of a broad bean. The separation of these nodules took place without any apparent inflammatory action, and consequently without the formation of a single drop of pus. The nodules which were embedded in the wounded surfaces also became loosened, and readily came away by the touch of the finger nail. After six weeks of this treatment all the nodules had disappeared out of the tongue, which had regained, to a great extent, its normal size, colour, consistency, and action ; the exposed surfaces had healed over; the flow of saliva had ceased ; the animal was able to eat his fodder without the slightest attempt at quidding ; had greatly improved in condition, and was excellent in health, in which he has continued for the last nine months. In fact, I am at present training him for racing. I may mention that I bought the horse, after his recovery, from his former owner, and subsequently sold him to the gentleman to whom I am now private trainer. I attribute these good results to the action of the iodide of potassium ; for on two occasions on which I discontinued this drug for three days the symptoms of swelling and hardness of the tongue, running of saliva from the mouth, and adherence of the nodules to the surrounding tissues, began to increase in a marked manner, until I recommenced giving this medicine, when they began to abate with equal quickness. The fact of a young three-year-old horse being able to tolerate such an enormous quantity of iodide of potassium as this one took, is extremely interesting to students of veterinary medicine.

DISEASE OF THE PANCREAS IN A HORSE.

By ALBERT WHEATLEY, F.R.C.V.S., Reading.

THE subject of this note was a roan gelding purchased in Yorkshire in October 1894. He was then four years old, fat, fresh, and apparently in good health. In November he was sent away on job, and he continued to give satisfaction until 21st March 1895, when he became much emaciated, though feeding well. He was then given boiled food, which seemed to improve his condition. In May slight oozing of blood from the coronets occurred, and it was observed that his "castors" (chestnuts) appeared to be shedding. On 19th June I saw the horse for the first time, found all four feet affected, blood and serum exuding from the coronets, frogs, and soles, and at places the horn of these parts was loose and underrun with pus. The "castors" were similarly affected. Horse very lame, temperature 102°, and pulse about 42. Having

pared the soles and lowered the heels, I placed the feet in poultices; and, as his appetite was capricious, prescribed quinine and chlorodyne, the latter to allay the pain. This treatment was continued until 1st August, when the horse was sent to my infirmary. At this time the skin of his legs became affected somewhat similarly to what is seen in some cases of purpura hæmorrhagica. The swelling extended upwards inside and outside of the thighs and forearms, along the abdomen and sheath. The nostrils were excoriated, eyelids swollen, and on one side almost closed.

I tested the horse with mallein with negative result, and tried astringent applications to the feet; but, as improvement could not be maintained, I decided to act upon Professor Macqueen's suggestion to send the horse to the Royal Veterinary College. I may add that during treatment his temperature frequently rose and fell—according to the condition of his feet. The feet required constant attention.

Royal Veterinary College Hospital Report.—Roan gelding, admitted 12th December 1895. Had been under veterinary treatment for some time. Temperature 102·5°, pulse 48, respirations 9. Much emaciated; skin broken by eruption at many parts; legs swollen, a few running sores on the hind limbs; lips œdematous; eyelids swollen; thick mucus running from eyes; thin discharge from nose; no glandular swellings; horse very lame; one knee enlarged; excoriations at coronets and bulbs of frogs. In one foot sensitive frog exposed; no fœtor.

Horse to be washed carefully and feet dressed with astringent.

14th December. Horse more comfortable, but no appreciable alteration in lesions. Feeding well.

15th December. No change.

Tested with tuberculin; no reaction. Skin eruption spreading; swellings larger; general appearance repulsive; disinfect skin until horse is destroyed.

Destroyed 24th December 1895.

Post-mortem.—The following notes of the *post-mortem* examination are supplied by Professor M'Fadyean.

Carcase very much emaciated; almost complete depilation of the skin of the limbs from the hocks downwards in the case of the hind limbs, and from the elbows downwards in the case of the fore limbs. The epidermis in many places is covered with dry brown scabs. Nearly complete depilation has also taken place around the nostrils, and over patches on the cheeks, forehead, and roots of the ears. The nostrils are tumefied, and their outer skin is excoriated.

Œdema of the textures of the abdominal wall. Peritoneum normal.

On allowing the intestines to fall towards the right side, there is brought into view, in front of the left kidney and in the position of the tail of the pancreas, a large greyish-white firm mass. On further examination and dissection, this is ascertained to be the left extremity of the pancreas. The entire organ is enormously enlarged and weighs 13 lbs. On section, its excretory ducts are found to be greatly dilated, the principal duct, before it leaves the gland, readily admitting two fingers. Between the dilated ducts one can recognise the greyish-yellow pancreatic tissue, which, however, appears to be cirrhotic.

The ducts are filled with a clear stringy mucus, closely resembling white of egg.

On slitting open the duodenum, the orifices of both large and small pancreatic ducts are found to be unobstructed, and, indeed, appear unusually wide.

The other organs of the abdomen and those of the thorax appear normal.

Microscopic examination of sections made from the enlarged pancreas after hardening in alcohol showed alterations of structure indicative of an interstitial inflammation of the organ. There is a marked excess of the interlobular connective tissue, and much of the gland structure is compressed or entirely destroyed by an abundant formation of cells (fibro-blasts) between the acini. Here and there are portions of lobules without any interstitial change, but with the acini much dilated, and their epithelium undergoing mucoid transformation.

DIPHTHERIA OF THE CAT.

By Henry Gray, M.R.C.V.S., Kensington.

I have frequently been asked by owners of sick cats whether they were suffering from diphtheria, but until the following case came under my notice I have always doubted the liability of the cat to a diphtheritic affection. Though I have met many cases presenting symptoms similar to the one I am about to describe, I have never before been able to induce the owners to allow a *post-mortem* examination, and, consequently, have never before been convinced of the formation of a diphtheritic membrane in the fauces of the cat.

The affected cats were three young Persians, aged eight months, of a slate-blue colour, splendid specimens of the breed, and very fat. The history of the case is as follows:—

Another young cat belonging to the same litter of kittens, and which had been reared along with the three I saw, was sold by the owner, and sent away on the 10th of February. It may have some bearing on the case that, about this time, a stray cat was seen about the area of the house where the four cats lived, but the owners were not certain that they had seen it before the cat was sold.

This cat remained perfectly well in its new home until the 25th, when it was seized with symptoms similar to those which I shall describe as affecting the others, and it died on the 28th. One of the servants from its old home, who had a good deal to do with the cats there, happened to be over at the house on the 28th, and nursed and poulticed the cat about ten minutes before it died.

The three cats which are the subjects of the present article remained quite well until the 4th of March, when all three suddenly became unable to eat, and on the 8th I was called in to see them.

I found all three in a condition of great prostration. They were sitting about the kitchen floor, the drooping position of the whole body indicating great weakness, and seemed somnolent. They remained sitting in the same place, moaning when moved or touched,

one only having sufficent energy to offer some slight resistance to handling or dosing. The following symptoms were common to all the animals:—

The coat was open, and its hair lustreless; the pupil was dilated, there was a slight discharge from the nostrils, and the breath was very fetid. When the mouth was opened the breathing had a gurgling sound, and the mouth remaining passively open unless the animal was stimulated by passing a spoon down the mouth. The soft palate was inflamed and very vascular. I did not thoroughly examine the throat, as there was no skilled assistant to hold the animals. None of the cats would eat, and I noticed a few drops of milk clinging to the hairs of the lips, which the animals had made no attempt to lick away.

At times there was slight vomiting, but, notwithstanding the severe nature of the disease and the exhausted condition of the animals, there did not seem to be much loss of body weight. Two of the cats, when made to move, had a staggering gait.

None of the three had any muco-purulent discharge from the ears, which I have noticed in some other cases of this sort.

The marked prostration and stupor, the fetidity of the breath, and the acuteness of the attack, coupled with the inflamed condition of the throat, led me to diagnose malignant angina, or so-called diphtheria of the cat. I endeavoured to maintain the strength by doses of brandy, and feeding with Brand's essence of beef, but gave a hopeless prognosis, which was speedily justified, two of the cats dying during the night of the 8th, and the third on the morning of the 9th.

On the morning of the 10th I succeeded in obtaining all three carcases. On opening two of them, and examining the fauces and larynx, I discovered a diphtheritic membrane, which led me to suspect that the disease had some connection with human diphtheria. I therefore at once sent the dead cat which was unopened, and the one least mutilated of the others, to Professor M'Fadyean. He has since informed me that in both cats he found an almost continuous greyish-white membrane on the fauces and anterior surface of the soft palate. Cultivation experiments did not reveal the presence of any diphtheria bacilli in the membrane; it contained a variety of organisms but the one most abundantly present was a small bacillus which on agar formed large white opaque colonies resembling those of the staphylococcus albus. He also informs me that he failed to transmit the disease to a young cat (six months old) by feeding it with milk to which particles of the diphtheritic membrane had been added.

This complaint seems to be very prevalent in the light-coloured breeds of Persians. I have seen chronic cases in which there was a hoarse cough, much resembling that of a croupy cockerel.

Whenever I have met these cases of malignant angina in cats I have always endeavoured to ascertain whether any of the members of the household were, before or after the illness of the cat, suffering from any similar affection of the throat, but I have never been able to prove such a fact. I may mention that the animals belonged to wealthy people, and the hygienic surroundings appeared perfect.

THREE UNCOMMON CASES.

By J. PENBERTHY, F.R.C.V.S., Royal Veterinary College, London.

INVAGINATION OF THE CÆCUM OF A HORSE.

THE subject, a bay gelding, aged five years, was admitted to the College infirmary on 5th February 1896. Previously the animal had been a patient of Mr E. S. Reid, M.R.C.V.S., who kindly supplies the following history.

"The patient had been treated for fever in my infirmary for a week, and was convalescent. On the 26th of January it had a sudden and sharp attack of colic. The acute symptoms subsided in a few hours, but there have since been manifestations of continual abdominal pain, the animal frequently looking to his flanks, lying down, and rising. Very little fæces and urine have been passed. Sedatives have been often administered, and once a purgative dose, after which there was considerable purging. The appetite has been poor, but a considerable amount of food taken each day."

On admission to the College infirmary the temperature was 105° F., pulse 60 and very feeble, respirations 22, mucous membranes pale. extremities cold. General depression was well marked, and abdominal pain evinced by frequently looking to the right flank while standing. When lying down for brief periods, usually on the right side, the head was often turned to the left flank. A draught composed of 2 ounces of tincture of opium, 1½ ounces of spirit of nitrous ether, and 1 ounce of concentrated solution of acetate of ammonia in water was given, which appeared to afford some relief. This was repeated after six hours.

During the night no urine or fæces were discharged.

On the 6th the temperature was 102° F., pulse 56, smaller and weaker, evidence of abdominal pain more marked, the animal frequently lying down and rising, and looking especially to the right flank; small quantity of liquid fæces passed, but no urine. Draughts repeated, catheter passed three times during the day, on the last occasion only a small quantity (about half a pint) of dark urine being obtained. This did not respond to the test for albumen. At this time a swelling was noticeable on the right flank, and on exploration *per rectum* a large hard swelling could be detected on the right side of the abdomen, somewhat nearer the roof than the floor. This moved under pressure, and could not be distinguished from a neoplasm or abscess. It is perhaps worthy of remark that there was no resistance to passing the arm up the rectum.

On 7th February, morning temperature 103° F., pulse 56; depression and the disposition to remain recumbent more marked. The appetite, which up to this time had been moderately good, was less, only a little food being taken. The evening temperature 105° F., pulse 60. Draughts repeated, catheter passed, but no urine obtained. Enemata frequently administered, and retained for considerable periods.

8th February. Temperature 104° F., pulse 64, smaller and weaker, animal remaining down greater part of the day. Treatment continued.

9th February. Temperature, pulse, and respiration not much changed, small quantity of fæces and a little urine passed. General appearance somewhat improved, food pretty freely taken. Treatment continued.

10th February. Little observable alteration, except increased depression. Small quantity of hard fæces removed from rectum. Treatment continued.

11th February. Morning temperature 105° F., pulse 90, manifestations of more severe pain. Evening temperature 106° F. Draughts repeated. Hypodermic injections of morphia administered. The animal almost continuously lies down. Small quantity of fæces removed *per rectum*.

12th February. Morning temperature 104·6° F., pulse 94. Evening temperature 106°. Same treatment as yesterday, no food taken. Animal evidently getting weaker.

13th February. Temperature 105° F., pulse 90; remains down in a somewhat drowsy state, frequently turning head to flank, and evidently sinking. Treatment as before.

14th February. Died in the early hours of the morning, after some struggling.

Post-mortem examination revealed a complete intussusception of the cæcum into the commencing portion of the colon. The vessels of the cæcum were engorged with dark blood, and the mucous membrane was becoming gangrenous. The parts of the colon in contact with the invaginated cæcum were inflamed, as was the mucous membrane of the ileum for about 18 inches of its posterior part.

In the wall of the cæcum, at its commencement, was a large cystic formation about the size of a child's head, lined internally by a gelatino-fibrinous material about ¾ of an inch thick, its cavity containing about three pints of clear serous fluid. Carcase very well nourished. Large amount of subperitoneal fat, peritoneum inflamed, and peritoneal sac contained about two quarts of a blood-stained, watery fluid. Liver undergoing cloudy swelling.

Spleen darker in colour than normal, but not enlarged; Malpighian bodies prominent.

Kidneys slightly congested, cortex darker than normal, and its consistency diminished.

The lower third of the left lung hepatised. Section shows numerous greyish areas, which emit a foul odour. A little subpleural emphysema in both lungs. A considerable amount of fat around the pericardium. Numerous ecchymoses from the size of a pea downwards on the heart wall.

In connection with this case the following circumstances appear to me worthy of remark. The sudden attack, the continued evidence of dull abdominal pain, and the absence of violent symptoms after the first few hours; the swelling of the right flank, and, as determined by rectal exploration, the existence of a somewhat hard, though compressible, moveable enlargement, corresponding to the sausage-like tumour described in similar conditions in the human subject; the retention of enemata, the facility with which the arm could be passed up the rectum, absence of tenesmus, continued high temperature, the fact of food being taken though in small quantities, the suppression of urine, and the duration of the illness (nineteen days).

This is the third case of invagination of the cæcum of the horse which has come under my notice, and the symptoms now recorded, though not perhaps identical with those existent in the other cases, are, I think, typical.

In Vol. VII., No. 4, December 1894, of this Journal, a similar case is recorded by Mr E. M. Jarvis, M.R.C.V.S. The subject, a mare, suddenly, during work, manifested evidence of acute abdominal pain, which continued in a much less acute form until death, which took place thirty hours after.

Here the course was much more rapid, and though there are some points of similarity in the two cases I am unable to detect in Mr Jarvis's record any evidence of rectal exploration revealing indication of enlargement in the abdomen. There was here noted passage of blood with the fæces, which I observed in one previous case, and which is so commonly noticed in intussusception in the human subject. On withdrawal from the rectum on one occasion in this case the arm was considerably blood stained.

In two of my three cases large numbers of the ascaris megalocephala were present, and in considering the etiology of the condition I was disposed to attach some importance to their presence. In the case now recorded there is the abnormality in the wall of the cæcum (cyst), which, I think, may possibly have been a factor in determining the occurrence.

Note.—Owing to absence of Professor M'Fadyean and myself the autopsy was made by Mr Heyes, Hospital Surgeon, whom I have to thank for notes of the lesions.

HÆMATURIA IN A MARE WITH DILATED URETER.

The subject, an aged chestnut carriage mare, came under the treatment of Messrs West and Pethick, veterinary surgeons, by whose courtesy I was enabled to examine the animal during life, and to make a *post-mortem* dissection of the urinary organs. The general health of the patient was good, and her state appeared normal, excepting some slight evidence of debility, frequent attempts to urinate, and the passage of considerable quantities of coagulated blood *per vulvam* while in the position of micturating. The coagula were bright coloured, moulded, about an inch in diameter, and discharged in lengths varying from 2 to 20 inches. The quantity of blood thus lost in a day must have been considerable, for during my observation, lasting about twenty minutes, the discharge occurred three times, in each instance nearly a pint being ejected. On exploration through the urinary meatus, which easily admitted a small hand into the empty bladder, a large round sausage-like body could be felt through the roof of the bladder. This, in conjunction with the size and shape of the coagula, led to the diagnosis of hæmorrhage into a dilated ureter. The mare being aged, and of little value, she was slaughtered.

On examination of the parts, kindly placed at my disposal by Messrs West and Pethick, I found the bladder and urethra normal; the right kidney somewhat enlarged and slightly congested, its pelvis dilated, and a small ulcerated spot in its lower portion; the right ureter, whose entrance into the bladder it is not always easy to find in a moment, was enormously dilated, and in its relaxed condition about one inch in diameter.

Rest, hæmostatics, diaphoretics, etc., had been tried for some weeks without improvement.

The cause of dilatation of the ureter could scarcely have been the hæmorrhage from the renal pelvis. It appears to me probable that some obstruction must have existed in the vesical portion of the ureter, causing its dilatation, and that of the pelvis of the kidney. This may possibly have been a calculus, while another may have induced the condition in the pelvis which gave rise to the hæmorrhage. One or two similar cases have been cited as resulting from the *eustrongylus gigas*, or giant strongyle, not often met with in the horse, and usually, though not invariably, destroying the kidney substance. In this case, however, I detected no positive evidence of calculus or parasite.

IMPACTION AND RUPTURE OF THE COLON, AND PARTIAL TWIST OF THE CÆCUM OF A MARE.

The subject, a bay van mare, aged seven, admitted 18th November 1895, had been regularly worked up to admission, the only complaint being that, on this morning, the animal was dull. On being brought to the College I could detect no evidence of disease, so advised that the animal should continue at work during the day, and be sent for re-examination in the afternoon. I then observed that there was considerable depression, temperature 101·5° F., pulse 50, fairly strong and full, and mucous membranes pale. I then advised that the mare be left for observation and treatment. Diarrhœa was noticed during the evening, and a little food was freely taken.

19th November. There is little change to remark, liquid fæces still being discharged. A stimulant draught administered.

20th November. Temperature 103·8° F., pulse 90, breathing quick and abdominal; animal much depressed and trembling, almost continually lying on right side, toward which the head is sometimes turned. No fæces or urine passed till 2 P.M., after which small quantities were twice discharged, and some signs of dull abdominal pain were observed. Rectal exploration was not resisted, and gave no other impression than that the abdomen was extra full.

21st November. Temperature 102·5° F., pulse 60, weaker, smaller, and harder; respiration frequent and laboured; no fæces or urine passed naturally, but about three pints of slightly albuminous, high-coloured urine withdrawn by catheter. Food and water refused till 5 P.M., when the animal appeared brighter and ate heartily. Later in the evening the mucous membranes were injected and icteric. The recumbent position is maintained during most of the day, and there is evidence of colicky pain. Stimulant draughts continued, and 6 ounces of sulphate of soda administered. Enemata injected three times.

22nd November. Temperature 103·7° F., pulse 80, small and weak. The improvement noticed last evening not maintained, the mare still lying down; no fæces or urine passed normally; about a quart of urine withdrawn by the catheter. Evidence of abdominal pain less. Stimulants and enemata repeated, and 5 drachms of aloes given.

23rd November. Conditions little altered; no fæces or urine passed

naturally till late at night, when purging commenced. Treatment repeated (except aloes).

24th and 25th November. Marked improvement; temperature 102·6° F.; appetite fair; fæces and urine passed in fair amount; animal stands well.

26th and 27th November. Conditions the same, except for evidence of general depression, which is increased, and swellings at the elbows (evidently from injury in lying down), under the abdomen, and at the right flank.

28th November. Temperature 103° F., pulse 70, slow and weak; breathing short and rapid; urine and fæces suppressed. Discharge of about 2 ounces of very dark-coloured urine followed withdrawal of catheter, and a small quantity of pultaceous fæces were removed from the rectum. Mucous membranes pale, extremities very cold, state approaching that of collapse. Stimulants with 6 ounces of sulphate of magnesia and enemata exhibited.

29th November. Animal brighter, temperature 102·8°, pulse stronger. Small quantity of pale dirty-coloured urine passed; no fæces discharged; animal lay down greater part of day. Treatment same as yesterday, with addition of 5 drachms of aloes.

30th November. Animal much depressed, temperature 103° F., pulse 70, hard and quick; no fæces or urine passed. Fifty minims of solution of physostigmatine injected into the jugular vein, and other treatment (except aloes) repeated.

1st December. Condition about the same, patient stands continuously, no fæces or urine passed.

2nd December. No alteration except that towards the evening it was noticed that the swelling in the right flank had materially increased in size; no fæces or urine discharged.

3rd December. Animal more depressed, is very weak, indisposed to move, standing all day in one position; evident pain in attempts to move right fore limb, which is much swollen about the elbow. Large abscess in right flank opened, from which came about three pints of pus; no fæces passed.

4th December. Temperature 103·4° F., pulse 80, weak. Animal feeds well, is brighter; respiration less hurried. Fair amount of normal coloured urine passed voluntarily; wound in flank discharging freely; no fæces passed.

5th December. Temperature 103° F., pulse 80. Mare feeding well, but no fæces passed. Mucous membranes pale.

6th December. Temperature 103·5°, pulse 76, respirations (25) hurried; mucous membranes pale; a very small quantity of hard fæces. Eats very little; abscess on elbow burst.

7th and 8th December. Same as on 6th, no fæces.

9th December. Temperature 104° F., pulse 70; general conditions little altered but appetite returned; no fæces; abscesses discharging freely.

10th December. Temperature 104·8°, pulse 78, respirations 25, hurried and irregular. No appetite, no fæces, animal less stiff. For the past ten days, in addition to stimulant and anodyne draughts, 4 ounces of sulphate of magnesia were given daily, and enemata four times daily. Six grains of eserine were now injected into the jugular vein. Some slight signs of abdominal pain followed, but no fæces.

11th December. Temperature 103·8° F.; pulse 70, fairly strong; respirations 20, and laboured. Weakness is manifest; no fæces are discharged, but the animal feeds; no sign of acute abdominal pain.

12th December. Temperature 103·6° F., pulse 75, feeble; respirations 26. Some evidence of colicky pains; no fæces; no marked alterations are appreciable till 5 P.M., when the mare is observed to be sweating, blowing, and extremely exhausted, temperature 101°, pulse too feeble to count. The animal died at 8 P.M., evidently having fallen down immediately before.

Post-mortem examination was made by Professor M'Fadyean, to whom I am indebted for the following notes.

Abdomen tympanitic. The double colon is enormously impacted with food material, especially its terminal portion, which is nearly as thick as a man's body. In the fourth portion of the colon is a tear about 8 inches long and evidently *ante-mortem*, its edges showing extravasation; around this the peritoneum is inflamed and covered with food material. The cæcum is mainly in the left hypochondriac region, and it is sharply bent upon itself, the point lying up against the liver. The capsule of the liver shows old thready growths. Thoracic organs normal.

In this case the more interesting features appear to be the absence of evidence of acute abdominal at the outset; the suppression of fæces and urine, the obstinacy of the bowels after continued administration of laxatives and enemata, two purgative doses of aloes, and intravenous injections of large doses of eserine; the facility with which enemata were given and retained; the duration of the illness (24 days); the disturbed respiration unassociated with tympanites; the pallor of the conjunctivæ; and the accession of symptoms three hours before death, considered in conjunction with the *ante-mortem* rupture of the colon. It will be remarked that the clinical evidence of rupture of the colon did not occur till fifty-six hours after the injection of the large dose of physostigmatine. The symptoms as a whole appear to be very different from those of acute impaction, the result of eating specially harmful food. This animal was one of five, most carefully fed and attended, and was not a greedy feeder. The cause was probably special to the animal. It is difficult to form an opinion on the evidence before us as to whether the inflexion of the cæcum was the primary cause of the obstruction, or whether the accumulation was due to changes in the walls of the colon and consequent loss of power to propel the contained ingesta.

It is remarkable that bending or partial twist of the point of the cæcum has received little or no consideration at the hands of British writers on the subject of volvulus. In his paper to the National Veterinary Medical Association, Veterinary-Captain Smith refers at some length to partial twist of the colon, but I find no mention of a similar condition of the cæcum, which I have observed in different cases of so-called "Impaction."

CLINICAL NOTES.

By Veterinary-Captain SMITH, F.R.C.V.S., Woolwich.

MALIGNANT TUMOUR IN A MULE.

THE following case only came under my observation *post-mortem*, but the history was very simple. An aged mule had for months suffered from a nasal discharge, which resisted all treatment, medical and surgical; during this time it was observed that the eyelids were swelling, and the sight apparently affected. The swelling of the eyelids continued until the eyes could no longer be opened, and all attempts at a thorough examination failed owing to the nervousness of the animal.

The appearance presented by the case was something exceptional,—a profuse nasal discharge, a snuffling almost snoring sound during respiration, and both eyes obliterated by enormously swollen eyelids. The appetite was good, but after months of treatment the animal was destroyed.

Post-mortem Examination.—The heart was enlarged, and weighed with its vessels 14 lbs.; the left auricle was surrounded by a growth which covered the pulmonary veins, and extended into the wall of the auricle, ventricular furrow, and part of the right auricle. The growth was pale and bloodless in appearance, and cut as firm as a lymphatic gland, which it somewhat resembled; its weight was 3 lbs. 13 oz.

At the bifurcation of the trachea was a large growth shaped something like a penis, and weighing about 8 or 9 ounces. In structure it resembled the material found in the heart, but possessed, in addition, a little dark pigment.

The eye on examination showed that the cornea in each was affected, the growth in one case having extended on to the eyeball, and both corneal surfaces were opaque. The eyelids were enormously thickened owing to the presence of a pale bloodless material, exactly resembling that found in the heart.

A longitudinal section of the head was made, and the upper surface of the soft palate was found to be affected with the same bloodless-looking growth found elsewhere, and the neighbouring parts both in front and behind this structure were invaded by the growth to such an extent as to materially reduce the calibre of the passage.

Above the pharynx were found on either side enlarged glands of a total weight of 3 or 4 ounces; the gland on the right side was very large. By their size and weight these glands must seriously have interfered with the respiration.

Within the ventricles of the larynx a thickening of the mucous membrane was caused by an invasion by the pale bloodless growth.

The sinuses of the face were healthy.

Remarks.—The case is rather a remarkable one. Of the nature of the growth I know nothing, but it was apparently malignant in character. Both the nasal discharge and difficulty in breathing were due to the diseased condition of the soft palate and surrounding structures.

ŒDEMA OF THE LUNGS?

A horse previously in perfect health was suddenly attacked one morning with dull abdominal pain; two hours later when I saw the animal it was collapsed and dying, great distress was present, pulse running down, nostrils much dilated; he crouched occasionally with pain, and fell twice. There was a little blood trickling from the nostrils, which we supposed to be due to a blow on the head inflicted when he fell. A little later there was some yellowish material running from the nostrils, and with it well-marked though small quantities of blood. He died within six hours of being attacked.

I suspected rupture of the stomach or intestines, but the abdominal viscera were quite healthy.

On opening the chest the lungs did not collapse, and in colour they were rather paler than usual; removed from the body they crepitated and crackled under slight pressure, and when cut into a perfect deluge of serum and froth flowed from the cut surface. This condition was most remarkable; wherever the knife went froth and serum followed. The trachea and bronchi were full of froth, while the entire lung substance was filled with minute air bubbles which could be seen under the tissue.

Remarks.—I have seldom made a more unsatisfactory *post-mortem* examination, for, though I have called the case œdema of the lungs, yet I candidly confess I do not know what it is. The abdominal pain and collapse drew my attention to the abdomen; I sounded the chest, but the lung sounds were only exaggerated in character.

Is there such a disease as acute pulmonary emphysema?

HEART DISEASE.

This patient fell for no apparent reason, broke its knees, and in consequence came under my observation. During the first day of its admission the animal fainted five times; without the slightest warning it would collapse, and fall heavily to the ground. The patient always rose without assistance within a few seconds of unconsciousness, and when the excitement of rising was over I found the pulse to be beating fourteen to the minute; I verified this a dozen or more times.

On auscultating the heart the first sound was present, but "thumping" in character. The second sound was sometimes entirely lost, while at others there was only a mere trace of a sound; in either case this was followed by a vibration of the chest wall, and apparently of the heart wall, as if the organ were spasmodically contracting, but it is most difficult to describe the sensation imparted to the ear. There were no murmurs.

The first sound was accompanied by such a "thump" on the ribs that the beats of the heart could readily be counted at a distance by observing the impulse; there was jugular regurgitation as high as the junction.

During a fit the pulse was almost entirely lost at the jaw, but as consciousness returned the pulse improved, though for some time it remained markedly dicrotic in character; and it was, in fact, the only dicrotic pulse I have ever felt in the horse.

There is very little further history to the case; the temperature was never above 102°, the pulse was generally 15 to 18, though one day it reached 36, and on another 42, while the respirations were 18. The patient fainted every day from two to five times, and by so doing got rather damaged.

The animal was destroyed under chloroform, air supply being as far as possible completely shut off. I expected the patient to fall an easy victim to the anæsthetic, but such was not the case, and the respirations ceased before the heart stood still.

The *post-mortem* examination was made at once. The heart was found enormously dilated, the long diameter of the left ventricle being 11 inches, and the same for the right. The ventricles were not only dilated; the walls were atrophied so that the thickest part of the left was thinner than an ordinary right ventricle. All the valves of the heart were healthy. When the organ was removed from the body it was so flabby that it collapsed through its own weight, as if the muscular tissue possessed no tone.

Remarks.—I diagnosed this case as disease of the semi-lunar valves, and I am at a complete loss to explain the absence of the second sound of the heart, considering that the valves were perfectly healthy.

The slow pulse presumably was due to the length of time it took the ventricles to fill and contract. I should not know from this case how to make a more accurate diagnosis in the future.

STRICTURE OF THE SMALL INTESTINES.

This patient, a mare, was admitted to treatment for dull abdominal pain, which was continuous. She was never violent, always lying quietly on her side, occasionally taking a look round at the flank, but no attempt at rolling. When standing she stood stretched out like a horse about to urinate, then turning the nose round to the flank she would flex a hind leg and gently nibble the stifle; this was repeated first on one limb and then on the other.

The symptoms lasted with very little intermission for thirteen days, during which time she had to be hand fed; then for three days there was a marked improvement, the appetite returned, and she only lay down once or twice a day. On the seventeenth day there was a relapse, but the pain was not continuous, and during the intervals the animal fed. From the eighteenth to the thirty-second day the pain was less, the patient during the intervals looking lively and feeding well, but on the last named day it was observed that there was more lying down than usual. On the thirty-sixth day there was acute pain, complete collapse, cold dripping sweats, gurgling and eructation up the œsophagus, and death soon followed.

Post-mortem Examination.—There was a rupture in the greater curvature of the stomach about 10 inches in length. The anterior half of the small intestines were spotted all over with blood extravasations, which extended around the circumference of the bowel excepting at its mesenteric attachment.

The wall of the small bowels (anterior half) was several times its normal thickness, being as much as ¾ to 1 inch in thickness. This increase in its substance was due to changes in the *muscular* coat and the submucous tissue, the latter in parts being jelly-like.

As the result of the enormous thickening of the muscular coat the lumen of the bowel was greatly reduced, and finally, by offering obstruction to the passage of ingesta, brought about rupture of the stomach by pressure from behind.

Remarks.—No microscopic examination was made of the thickened muscular coat, but it appeared to be simply hypertrophied, and this hypertrophical condition ceased quite abruptly about the middle of the small intestines. The mucous coat of the bowel was perfectly normal.

I have no explanation to offer as to the probable cause of the trouble, and I have never met with the condition before or since.

The case is a good example of rupture of the stomach from internal pressure and not external violence. Throughout the whole attack the animal took the greatest care of herself and always lay down very carefully. The attitude when standing and the nibbling of the stifles are curious symptoms.

Though I have described this case as stricture of the small intestines it is only so named after the most prominent *post-mortem* lesion ; the actual disease existed in the intestinal wall, so that it might equally well be called hypertrophy of the muscular coat of the bowel.

CARCINOMA OF THE PLEURA.

This horse was admitted with symptoms of pleurisy, and lived twenty-two days. It is unnecessary to detail the clinical history of the case. It apparently ran the ordinary course of pleurisy, and when effusions occurred several tappings were performed. The end came somewhat suddenly.

Post-mortem Examination.—The chest was full of yellow serum, clear and free from smell ; on mixing with blood this fluid clotted. There was so much fluid in the chest that it was difficult to understand how any accommodation was found for the lungs.

On removing the chest wall it was found that the entire pleural surface, both costal and pulmonary, was covered with grape-like growths, which extended on to the diaphragm. These growths were lobulated, pink in colour, with a pearly lustre, and were larger on the anterior ribs than elsewhere ; in fact, attached to the first ribs were growths of very considerable size. On section the growth looked and cut like lymphatic gland.

On the lungs the growth was confined almost entirely to the anterior lobes and lower edge, and in no case was the lung tissue affected, only the pleura ; and from the edge of the lung the deposits were suspended. Between the lungs was a calcified lymphatic gland.

In the pericardium the most astonishing changes had occurred. The pericardial sac was enormously enlarged, lobulated on its surface from the presence of the pink pearl-like growth, and as unlike pericardium appearance as anything could well be. The interior of the pericardial sac was normal. The mass weighed several pounds, and extended into and implicated the mediastinum.

Remarks.—I took the disease for tuberculosis, but Professor M'Fadyean, who examined the growth, found it to be carcinoma.

This extraordinary specimen is cast in wax, and will be found in the museum of the Royal College of Veterinary Surgeons.

THE NEW PHOTOGRAPHY IN VETERINARY PRACTICE.

By FRED. HOBDAY, Professor, Royal Veterinary College, London.

THE application of Roëntgen's rays to veterinary practice may seem somewhat in the future as regards the larger animals, but for the smaller ones it certainly is likely to prove of value in diagnosing obscure cases of certain kinds; the chief objection, perhaps, at present being the expense of the apparatus, a thing which time and the more general use of the instrument will probably alter.

The following cases are of interest as showing its practical utility. For the photographs I am entirely indebted to Mr Sidney Rowland, B.A., who very kindly took them at my request, using a 3-inch spark given by a large induction coil and exciting one of the new "x" ray vacuum-tubes.

CASE I. was a Persian cat, five or six years old, pregnant, and expected to have kittens within a few days.

The object of photographing her was to endeavour to ascertain the number of fœtuses *in utero.*

She was secured to a small table on her abdomen by hobbles, and an anæsthetic was cautiously administered in order to produce perfect quietude; ether was first used, but this was changed to chloroform; unfortunately signs of danger appeared before she had been under the exposure of the rays for a sufficiently long time to produce a good negative, and the observations had to be discontinued. Shortly afterwards another attempt was made, the animal being secured by means of hobbles and bandages without any anæsthetic, but in this instance again the animal managed to move before a sufficient time had elapsed. The negatives, when developed, showed clearly the vertebral column and pelvis, an indistinct shadowy mass of what was probably intestine, and an outline of the uterus with contents, but the latter was too indistinct to give any definite information as to the number of fœtuses. Unfortunately, we did not get an opportunity to make another attempt before the cat gave birth to her kittens.

CASE II. was a cat brought to the Free Clinique suffering from a fibrous union of the bones of the forearm as a sequel to a fracture. The owner said that the fracture had occurred sometime during last September, but that he had not taken any notice of it for about three or four weeks, thinking that probably there was nothing seriously the matter, and that it would get all right; in October he brought it to the Clinique, when it was found that a callus had formed. The cat never used this limb as well as the others, and in January the owner noticed it to be slightly swollen; this swelling increased, and on the 17th of March the owner again brought the animal for advice. Examination revealed distinct crepitus at the bottom of the ulna, and a large swollen fibrous union at the lower end of the radius. Amputation was advised, but before performing the operation I took the animal to Mr Rowland in order to see whether a photograph of the diseased part would warrant the adoption of any other course of treatment. An exposure of three-and-a-half minutes to the "x" rays

was allowed, the result being a confirmation of the diagnosis. On the 19th the animal was placed under choroform, and the limb amputated. At present all is going on favourably, and the patient promises fair to make a good recovery.

CASE III. was also a cat, a Free Clinique patient, suffering from lameness, and having distinctly perceptible a foreign body subcutaneously situated in the upper and anterior portion of the forearm.

Cat's Leg referred to in text, CASE III. The foreign body is seen as a dark triangular object in the soft textures a little below the elbow joint.

I took the animal to Mr Rowland, who obtained the photograph here shown after an exposure of two-and-a-half minutes, the animal being kept perfectly still by the aid of hobbles and chloroform. The next day the foreign body was extracted, and proved to be a small flat piece of metal with an exceedingly sharp point.

Abstracts and Reports.

PULMONARY MELANOSIS OF THE CALF FROM THE POINT OF VIEW OF ALIMENTARY HYGIENE.

FROM a study of materials collected in the abattoirs at Milan, and examined in the pathological laboratory of the veterinary school there, Fiorentini has arrived at the following conclusions:—

It is relatively frequent to find here and there at the surface of the lungs in calves black spots; similar spots are also encountered in the other organs, such as the liver, spleen, etc. On the other hand, it is very exceptional to find these in adult animals. The spots are found to be formed of granules of melanin pigment.

This melanosis of the lung and of the other viscera of the calf appears during the first moments of extra-uterine life; it is destined to disappear in the adult animal, and it is not accompanied by the formation of neoplasms, such as carcinomata or sarcomata, like those met with in man and in grey horses.

It is concluded that the presence of such melanotic foci in the organs of the calf in no way renders these unsafe for human consumption.—*Revue Vétérinaire.*

A DISEASE OF NEW-BORN CALVES.

In the course of last winter a disease broke out among the new-born calves in the neighbourhood of Pavia and was the cause of heavy losses. The veterinary surgeons were not agreed regarding its nature; some of them considered it a special form of enteritis and diagnosed it as the diarrhœa of calves (white scour), while others regarded it as a form of nephritis. Monti and Veratti made investigations regarding the disease in the pathological laboratory of the University of Pavia, and were able to verify the existence of albuminuria and diarrhœa, which, however, they found to be merely the local manifestation of a general infection. Their researches led them to the following conclusions.

First.—The disease of newly born calves is a general infection which has its starting-point in the digestive tube.

Second.—This infection, which is characterised by diarrhœa and albuminuria, determines grave alterations in the intestine, the lymphatic glands, the kidneys, and the brain, and, secondarily, congestion and small hæmorrhages in a great number of other organs.

Third.—The specific agent of this infection is a bacillus related to the *bacterium coli commune;* it passes from the intestine into the circulatory apparatus, and leads to the development of numerous colonies in all the organs.—*Revue Vétérinaire.*

RESEARCHES REGARDING AVIAN TUBERCULOSIS.

MM. Cadiot, Gilbert, and Rogers, as the outcome of their researches, conclude that the bacillus which is the cause of tuberculosis of fowls and that which causes the disease in mammals are two varieties or races of the same species, and they consider it possible that the one may be transformed into the other. These conclusions are based on eighty-five experiments. The tuberculosis of fowls is easily inoculated to the rabbit, but with more difficulty to the guinea-pig. However, after several passages in mammals it may become very active for the guinea-pig, and, as with the human virus, set up the development of visceral granulations; at the same time it may lose its pathogenic powers for the fowl. In order to observe such modifications in the virulence of the bacillus of avian tuberculosis it is necessary to carry on experiments for some years, and to remember that tuberculosis of the fowl is not caused by a fixed or uniform virus, but by one which varies notably in virulence from bird to bird.

In less than a year these same authors have been able to collect fifty-seven cases of tuberculosis in parrakeets, and they find that in this species the disease assumes such special characters as to make it impossible to determine the real nature of the malady except by the discovery of the bacillus. In general the disease is manifested by cutaneous lesions which are comparable to some

forms of verrucose lupus. The lesions are seated about the head, especially on the jaws, around the eyes, and at the commissures of the lips, while they often invade the buccal and lingual mucous membrane, and more rarely they are seated on the legs, wings, or other regions of the body. The researches of these authors show that the tuberculosis of parrakeets is often, if not always, of human origin. In these birds the bacillus acquires a very marked degree of virulence for certain mammals, as is proved by inoculations performed on the guinea-pig. The bacilli are found in large numbers in the cutaneous lesions, in the saliva, in the nasal secretion, and sometimes also in the excreta. Parrakeets which thus acquire the disease from man may in turn become centres for the infection of human beings.—*Revue Vétérinaire.*

ACQUIRED IMMUNITY AFTER AN ATTACK OF FOOT-AND-MOUTH DISEASE.

On a particular farm the whole of the cattle, to the number of 145, were attacked with foot-and-mouth disease in a severe form. A year later the disease broke out again among some animals on the same farm, and in order to shorten the outbreak an attempt was made to infect all the animals not naturally attacked, by taking some saliva from the mouths of those already affected and placing it between the lips of the healthy; in the majority of cases the disease developed in three days after this attempt to infect, but fifty-five out of the total of 130 animals in the place remained healthy, and it was ascertained that these fifty-five had all suffered from the disease during the previous outbreak. They had therefore retained their immunity for a year.—*Berliner Thierärztliche Wochenschrift.*

THE SURGICAL TREATMENT OF QUITTOR.

In the *Deutsche Zeitschrift für Tiermedicin*, Professor Bayer of Vienna has described a new method of operating in the treatment of quittor involving the lateral cartilages. Briefly described it is as follows:—

The day before the operation the hoof is pared, thoroughly cleansed by means of a brush and an antiseptic bath, and enveloped in a piece of cloth saturated with a disinfectant liquid. The horse having been cast and anæsthetised and the hair shaved away from the coronet and pastern, the whole of the hoof is again disinfected and an elastic ligature or Esmarch bandage is placed on the leg; this having been done the whole upper part of the quarter which covers the cartilage is extirpated. As the next step one incises the podophyllous tissue parallel to the semicircular edge of the breach made in the hoof and at least half a centimetre from this edge; the two extremities of the incision are now prolonged upwards across the coronary cushion, as far as the upper edge of the cartilage, and the elliptical piece of tissue which is thus isolated is separated from the subjacent cartilage by careful dissection, so as to entirely expose the cartilage. The cartilage is then seized with a pointed dissecting hook, and extirpated more or less completely according to the case. If in the course of the operation a vessel of any size is cut it must be ligatured with fine catgut. The orifice and the canal of the fistula are carefully scraped with a sharp curette. The operation wound is then washed and lightly powdered with iodoform, and the flap is brought back into place and fixed by aseptic silk sutures inserted at its periphery; these sutures are inserted not only into the skin of the coronet, but also into the

coronary cushion and the podophyllous tissue. After having again disinfected the field of operation the following dressing is applied.

In the first place the whole of the surface is covered with iodoform gauze, and on the top of this one carefully places small pads of sterilised tow along the breach made in the wall of the hoof, in order to prevent engorgement of the podophyllous at this level; small pledgets are also added so as to maintain the inner face of the flap of skin in perfect contact with the bottom of the wound produced by the removal of the cartilage. Finally the whole is fixed by means of a calico bandage saturated with solution of sublimate. In applying the bandage it is necessary to take particular care to avoid dragging from below upwards on the flap, which is best done by making the turns of the bandage from above downwards on the region of operation. The dressing having been terminated, one removes the Esmarch bandage or the rubber tube applied round the limb.

In the majority of cases the dressing immediately afterwards becomes visibly saturated with blood, even when one has taken the precaution to ligature the smaller vessels. This subsequent hæmorrhage is not of any importance, as the blood which accumulates in the wound remains aseptic, and may even be considered to furnish material for the formation of cicatricial tissue. In order to protect the dressing, one may either surround the hoof with a piece of thick cloth or with a leather boot. The time for making the first change in the dressing cannot be absolutely fixed; if the horse continues to rest weight on the affected foot, and if there is no sign of very severe pain, one may wait even to the fourteenth day.

In twelve cases of quittor Professor Fröhner of Berlin has operated in this manner with complete success. In all cases he obtained union by first intention, and the cure was complete in from four to six weeks. He is therefore able to confirm the advice given by Bayer, who discards all medical treatment for cases of quittor, and advises that the operative procedure should always be preferred when one wishes a sure and rapid cure.—*Journal de Medècine Vétérinaire.*

THE PATHOLOGY OF MILK FEVER.

NOCARD has always believed that milk fever is of an infectious nature, and whenever he has had the opportunity he has searched for the microbe, but always without success. All the attempts that he has made at cultivating an organism, whether from blood, bile, etc., or from the solid organs, such as spleen, liver and kidneys, have failed.

In the course of his researches he has observed that in milk fever the urine always contains sugar; he considers that this is the only disease of the domestic animals in which glycosuria is constant, though in rabies, especially in the herbivora, sugar very frequently appears in the urine. In the latter disease the final paralysis is manifestly of bulbar origin, just as the glycosuria is, and the medulla oblongata is always virulent. Nocard therefore thought that perhaps he might find in the medulla oblongata of cows that had died from milk fever the organism which he supposes to be the cause of the disease, but his attempts in that direction have also failed, the media inoculated from the central nervous system, whether from the brain, medulla oblongata, or spinal cord, having always remained sterile.

It is now a well-known fact that in tetanus the bacillus remains confined to the initial wound or its immediate neighbourhood, and that all the symptoms of the disease are due to the action of toxic substances which the bacillus elaborates where it has been deposited. This suggested that the same might be the case in milk fever, and Nocard therefore returned to the old hypothesis

which attributes the disease to a uterine infection. However, he has never found that the uterus presented any abnormality in the *post-mortem* examinations that he has made, but he does not regard this as sufficient proof that the disease is not due to uterine infection, for the tetanus bacillus does not excite any visible lesions in the tissues where it exists, though its toxins are none the less terrible in their effects on that account.

Nocard therefore applied to veterinary surgeons in practice, requesting them to send him with all the despatch possible the uterus of cows which had been killed in the course of milk fever, the womb to be sent unopened, and with a ligature tied round the vagina. He has thus been able to study in a large number of cases of milk fever the condition of the uterus as regards the presence of organisms. In some cases the uterus was already altered, and in others it enclosed more or less putrid remains of the placenta; but in seven cases it arrived in good condition, and in all these instances the fluid obtained by expression of the mucous membrane or the cotyledons yielded cultures of bacteria in all the media inoculated. But at the very outset it appeared that these cultures were very impure. On the solid media, especially potato, there developed colonies varying in size, outline, and colour, and brief examination showed that these were simple varieties of the pyogenic staphylococci—aureus, albus, citreus. In three instances he also found the bacillus coli, and twice streptococci were present, but in two cases the staphylococci were present alone, and in five other cases they occurred along with other microbes, but in greater abundance than them.

The constant presence of staphylococci in the uterus of cows attacked with milk fever leads Nocard to believe that this microbe plays an important *rôle* in the pathology of the disease. The fact that he has never found such organisms in the medulla or in the spinal cord of the animals which he has examined indicates that the symptoms are not the direct effect of the organisms in these situations, but he surmises that they may be the indirect effect, though the agency of toxic products generated by these organisms in the thickness of the uterine mucous membrane. It is known that animals which appear to have resisted the injection of a small dose of the culture of the staphylococcus may nevertheless succumb some time afterwards from paralysis, and he thinks that the normal variations of functions produced during the late stages of pregnancy and after parturition may facilitate the action of toxic substances manufactured by staphylococci. This, Nocard admits, is merely a hypothesis, but he suggests that it might be tested by injecting filtered cultures of the staphylococci into cows at the point of calving.—*Recueil de Med. Vet.*

MASTITIS OF THE COW AS A CAUSE OF ACUTE GASTRO-INTESTINAL CATARRH IN THE HUMAN SUBJECT.

WITHIN recent years streptococci have been found associated with certain forms of diarrhœa in the human subject, and in 1894 Holst had the opportunity to observe a series of cases of acute gastric catarrh which he attributed to the action of these organisms.

In the first series in one morning eight individuals belonging to three different families in the same street were attacked four hours after they had partaken of milk; four members of the families who had not drunk any of the milk, or who had taken it in the cooked condition, were not affected; only one child who had taken the milk cooked was affected, but in this case the attack was slight. The milk had all been obtained from one dairy, and it showed nothing abnormal in respect of its naked-eye characters; however, it

coagulated on heating, and it showed a large number of micrococci, especially streptococci, which could not be distinguished from the streptococcus pyogenes longus. This discovery suggested that the milk had become contaminated with pus from a cow as a result of an attack of mastitis. The examination made by a veterinary surgeon confirmed this opinion, for among the cows of the dairy in question he found one suffering from diarrhœa and parenchymatous inflammation of the udder. The cow had been affected for a fortnight previously, but during that time its milk had not been mixed with that of the other cows; on the morning in question it had been so mixed owing to a mistake on the part of a new attendant.

In the second series of cases five persons were attacked with acute gastro-intestinal catarrh two hours after they had consumed raw milk from the same source. Subsequently it was ascertained that a number of other persons had been similarly attacked. In this case also a veterinary examination of the cows showed that one of them was affected with parenchymatous inflammation of the udder. The milk of this cow was quite normal in appearance, but it contained numerous pus cells in which streptococci were included.

In the third series of cases a mother and her child were attacked after drinking raw milk, which, as a subsequent examination showed, contained numerous diplococci and streptococci; the milk was flocculent, thin, and contained pus-like particles. In the dairy from which the milk had been obtained it was found that two cows were affected with parenchymatous inflammation of the udder.

In the fourth series of cases four children in one family were seized after drinking fresh milk, which to the naked eye appeared quite normal. Subsequent enquiry brought to light the fact that on this same morning a cow suffering from inflammation of the udder had been sold out of the dairy from which the milk had been obtained.—*Zeitschrift für Fleisch und Milch Hygiene.*

THE MAXIMUM MUSCULAR EFFORT OF THE HORSE.

THE subject of horse traction has given rise to many experiments, principally to determine the most favourable load to be drawn under various conditions of road and pace. Such experiments were of the greatest interest and value, especially in the days of mail coaches, when it became an important matter to determine the heaviest weight a horse could draw at a given pace without shortening its useful life.

The observations which Veterinary-Captain Smith has undertaken are somewhat different; no attempt has been made to ascertain the most generally useful force a horse should exercise in draught, but the enquiry has been directed towards ascertaining the maximum amount of force a horse is capable of exerting at a given moment—in other words, to determine the limit of his power.

A horse attached to a dynamometer throws himself into the collar, and bounds forwards when he finds he is unable to move; Captain Smith did away with this difficulty by not securing the dynamometer to a post or tree, but attaching to it a long rope on which were placed a certain number of men. These men were trained to move forward with the horse in the first instance, and then gradually to put their united weight into the rope, and so resist the animal's progress in a perfectly even manner.

As the horse experienced the resistance he exerted more strength, and either pulled the whole of the men along readily (in which case more were placed on the rope), or was only just able to move the resistance. This latter was taken as the limit of his power, and the steady pull registered at this moment by the dynamometer was recorded.

All the experiments were conducted on a level surface covered by a thick layer of tan; this afforded a good foothold to the horse and prevented any accident in case he fell.

The muscular force a horse can exert in draught is governed by the weight of its body; other things being equal, a heavy horse will pull more than a light one. In these experiments an attempt was made to determine the proportion which the body weight bears to the limit of power, and for this purpose all the horses were weighed.

The total number of observations made was eighty-three, and the number of horses employed was eighty. The observations may be grouped under four heads, the grouping being determined by the spirit in which the horse did its work. For example, a horse is classified "excellent" which met the gradually increasing resistance by a gradual increase in force, eventually straining his utmost, sometimes lowering the body until the knees almost touched the ground in order that more weight might be placed in the collar, whilst one which met the resistance by relaxing instead of increasing its efforts, and was only made to pull by dint of stimulation, is classified as "bad"; between these extremes come "good" and "fair"

In the group "excellent' there are thirty-seven observations; the average weight of the horses was 1526 lbs., and the average weight pulled was 986 lbs. One may therefore say that a horse exerting itself to the greatest possible extent cannot exercise a dead pull of more that 78·5 per cent. of its body weight.

In the group "good" there are fifteen observations; the average weight of the horses was 1213 lbs., and the average weight pulled was 942 lbs., or 77·6 per cent. of the body weight.

A group of "fair" pullers, ten in number, gave an average body weight of 1201 lbs., and an average pull of 848 lbs., or 70·6 per cent. of the body weight.

In the group "bad" some horses are included which were classified as "indifferent"; the total number forming the group is nineteen, with an average weight of 1225 lbs., and an average pull of 804 lbs., or 65·6 per cent. of their body weight.

This enquiry only tells us the greatest effort a horse may exert at a given moment; it does not deal with his useful effective force in draught. This latter is liable to considerable variation, the state of the road and nature of the vehicle being the most important factors.

As a means of comparison with the above results Captain Smith quotes Brunel, who considered a force of traction of 100 lbs. to 150 lbs. to be the most suitable for slow work of eight hours per diem; one may take the average of this at 8 per cent. of the body weight. During fast draught work the effort is considerably reduced; 40 lbs. per horse was the force of traction employed in the fast mail coaches of years ago, or four per cent. of the body weight, taking the latter at 1000 lbs. Under these conditions a day's work was performed in about fifty minutes, the stage being eight miles.—*Journal of Physiology*, No. 3, 1896.

EPIDEMICS OF TRICHINOSIS.

In Kelbra-Altendorf, in July 1895, about 240 persons were attacked with trichinosis. The symptoms exhibited by the patients differed to some extent from those commonly observed; in most cases the patient experienced nausea, but yet did not vomit; fever of considerable height soon set in, and to this there were added dull headache and dragging pains in the legs, as well as in the neck, forehead, and orbital regions. These symptoms were speedily followed

by swelling of the face, especially of the eyelids, in a great number of the patients. Another constant symptom was pain in the abdomen, which was generally accompanied with severe exhaustion; when a purgative was administered the patient passed typhoid-like stools. The epidemic had an unusually mild character, for only one patient died. A striking feature of it was that no children were affected; a larger proportion of men than of women were attacked. At first the doctor who attended the patients mistook the disease for typhoid, although all the patients admitted that they had recently partaken of minced pork in the raw state. The *post-mortem* of the one fatal case made the diagnosis certain. At this it was observed that the muscles were of a deep red colour, and in the first preparation examined several trichinæ were found, some free between the muscular fibres, and others in the first stage of encapsulation, indicating that infection had taken place about six weeks before death. Subsequent enquiry showed that both the butchers from which the pork had been purchased lay under suspicion, as they had frequently before bought meat of an unwholesome character, and had not submitted all the pigs to examination. It was also ascertained that the trichina inspector had not himself taken the portions for examination, nor had they been taken in his presence from the slaughtered animals; his examination had extended only to flesh taken from one pig, although several pigs had been simultaneously slaughtered.

In August 1895 it was reported that an epidemic of trichinosis had broken out in Klein-Quenstedt, a small village with 648 inhabitants. The information came from the doctor who had made the diagnosis, but four other practitioners had set the affection down for gastric fever, acute rheumatism, or influenza. The symptoms were such as are usually observed, but in some of the patients the extremities, especially the arms, were swollen; in some of them movement of the eyeball was attended with pain, and in addition to the pain in the muscles during rest, movement, and pressure, there was a striking feeling of depression and weakness; pain in the chest was also frequently complained of, and in some patients, in consequence of this, there was shortness of breath. Pain was also experienced in the muscles of mastication and deglutition. In the case of eight patients at the outset of the disease there was nausea and vomiting, but only one single patient had diarrhœa. The whole of the fifty-five persons attacked had on the 28th July eaten minced pork in the raw condition; this had all been obtained from one butcher. Some had also eaten sausage made from the same pig, and in one case only sausage had been eaten. The first symptoms of illness set in eight days after the consumption of the flesh. In this epidemic also, it is a striking fact that no children were attacked, and no case ended fatally. The diagnosis could not be made absolutely certain, since trichinæ were not discovered in the piece of muscle excised from the biceps of one of the patients and submitted to microscopic examination. The trichina inspector who had examined the pig in question affirmed that he had taken pieces the size of a hazel nut from the diaphragm, the root of the tongue, the muscles of the eye, and the intercostal muscles; from each of these he had made three preparations, and he had spent three-quarters of an hour in the examination.

In the year 1884 an epidemic of trichinosis occurred in the village of Strenz-Neuendorf. The village numbered 630 inhabitants, and of these eighty-six or 14 per cent. were attacked, and twelve of the cases or 14 per cent. of those attacked ended fatally. All the patients admitted that they had eaten pork. In one small piece of sausage made from the flesh of the pig suspected of having been the cause of the outbreak, the examination of the first microscopic preparation revealed eight trichinæ. In this outbreak also, it was observed that the symptoms were much less severe in children than in adults. A specially interesting case was one in which a girl eight years old, along with

her father, ate some raw pork, both about the same quantity; the father was severely attacked and lay for a long time in a dangerous state, whereas the child never made any complaint and showed no symptom of trichinosis. On the other hand, among the patients there were nine under ten years; one child of two years showed distinct though not severe symptoms, and in two children aged respectively eight and six years the symptoms were severe but they speedily disappeared. The latter two children belonged to the family of the butcher who had slaughtered the trichinous pig. Of the patients, the majority, namely twenty-seven, had eaten the flesh raw, while nineteen had eaten it as imperfectly roasted sausage, and four had eaten it after boiling. The largest number of attacks took place on the eighth day, corresponding with the period at which the trichina embryos wander outwards. Of the twelve fatal cases ten had eaten raw flesh and the other two had partaken of it imperfectly roasted. On an average in the fatal cases death occurred on the thirty-seventh day after the consumption of the flesh; the earliest case occurred in the third week, and the last in the seventh week. It appeared that up to the tenth year the disease in general ran a milder and more favourable course, but a fatal termination took place in a girl of ten-and-a-half, and also in her two brothers aged respectively fourteen and sixteen years. At the *post-mortem* of one patient the muscles were found to be so infested with trichinæ that in a preparation made from the laryngeal muscles thirty trichinæ could be counted in one field of the microscope. The person who acted as trichina inspector in this village was a drunkard, and his examinations had been made in an extremely careless and superficial manner. There was subsequently found in his possession several mounted preparations taken from the pig in question, and in every one of these trichinæ could be recognised without difficulty, and indeed in such numbers that no inspector could with ordinary care have overlooked them.

In commenting upon the foregoing reports Scherk remarks that they furnish evidence that the regulations regarding trichina inspection in Germany are not sufficient to prevent epidemics of trichinosis. Experience has shown, especially in the province of Saxony, that epidemics occur from year to year. In the year 1865 Scherk had the opportunity to observe the deadly epidemic at Hedersleben, in which out of 2100 inhabitants 337 were attacked with trichinosis and 101 died. Scherk points out that in the pig trichinosis does not lead to any notable disturbance of the animal's health, and mentions that the animal which was responsible for the epidemic at Hedersleben had been exhibited in the shop as an unusually fine carcase. On account of the splendid appearance of this animal a workman specially desired to be supplied with a portion of flesh from it, and when he received it it was consumed by himself and his family in the raw state; neither he nor any member of his family was attacked, but it subsequently transpired that because the workman was a bad customer he had been supplied with flesh from another and, as it was thought, inferior pig. Scherk believes that trichinosis is stationary in the province of Saxony because the graves in which trichinous patients have been buried serve as new centres for the dissemination of the disease; he believes that rats devour the corpses, and that they in turn are eaten by pigs, and so the opportunity for the fresh infection of the human subject is brought about. He therefore believes that all patients who succumb to trichinosis ought to be cremated.

Liebert combats the above mentioned views of Scherk regarding the causation of epidemics of trichinosis. He cites the case of a locality in which every year a large number of pigs were reared; in each of three years out of ten one pig was found to be trichinous, although during this time no human being had died in this place from trichinosis, nor had any person who had left the locality been affected with that disease. Transmission of the trichinæ

by means of the bodies of human beings was therefore in this case excluded; moreover, Liebert points out that even among the very poor dead bodies are protected from rats before burial, and that in graveyards it is improbable that the rats ever penetrate as far as the dead bodies. He contends that it is much more probable that only the pig and the rat are concerned in the *circulus vitiosus;* he points out that dead rats are devoured by their fellows within a few hours after their death, as may be observed in rats kept in cages. Moreover, when rats in confinement are starved the stronger soon kill the weakest and devour them, the head especially being gnawed away; it is also a habit of rats to greedily consume flesh of any sort to which they have access. On the other hand, rats are frequently eaten by pigs. Trichinosis is mainly maintained by transmission from rat to rat. When pigs are slaughtered it is a common precedure to cut out the eyes, and to cut off the ears and the end of the rectum and throw these away. In large slaughter-houses it is the custom to collect all such materials and either to burn them or sell them in the cooked condition for dogs' meat, but in many private slaughter-houses such offal is simply thrown on the dung heap, where it serves as a vehicle for infection of mice and rats. Liebert therefore thinks that with a view to the prevention of trichinosis it ought to be obligatory on inspectors to see that such offal is carefully collected and burnt; as a further precaution wherever pigs are kept an attempt ought to be made to kill all the rats, and when a dead one is discovered it ought to be burnt.—*Zeitschrift für Fleisch und Milch Hygiene.*

EQUINE HÆMOGLOBINURIA.

In a recent number of the *Berliner Thierärztliche Wochenschrift*, Professor Dieckerhoff contributes an article in which he advocates a new method of treating this disease. The author says that there are few diseases of the horse regarding whose etiology opinions are more at variance than they are with respect to the nature of hæmoglobinuria. This difference of opinion is shown by the large number of different names for the disease. Although half a century has elapsed since Dieterichs called attention to lumbago of the horse, and since Hofer offered an explanation of the "black disease," the additions to our knowledge relate almost exclusively to the etiology of the disease and its morbid anatomy. It thus happens that while one can formulate well-grounded regulations for the prevention of the disease, the morbid anatomy does not furnish any rational guide to successful treatment.

In his text-book on "The Special Pathology and Therapeutics of the Domestic Animals," Dieckerhoff has fully discussed the prevailing views regarding the nature of the disease, and he contends that none of them is altogether satisfactory. The view which Böllinger urged (1877) has been very generally accepted. Böllinger defined the disease a "hæmoglobinuria toxæmica," and ascribed the symptoms and lesions to the action of a hypothetical poison or toxic principle. Dieckerhoff, while accepting this view, cannot assent to the conclusion that the hæmoglobinuria and subsequent nephritis induced by this toxic substance constitute the immediate cause of death in fatal cases; on the contrary, he maintains that not merely in the slight, but also in the severe cases, in which the urine contains much hæmoglobin, interference with respiration, and destruction of skin and subcutaneous tissue, with resorbtion of degeneration products, are the common causes of death.

The most important and the most dangerous factor in the complex disease is the painful affection of the skeletal muscles, especially of the muscles of the

hind quarters; it is therefore of the utmost importance to consider how the peculiar irritation and parenchymatous inflammation of the skeletal muscles is brought about. Perhaps light might be thrown on this point by chemical examination of the recently diseased muscle, but at the present time, in attempting to explain the pathology of the disease, one is confined to hypothesis. For the last ten years it has been a well-known fact that hæmoglobinuria as a rule only attacks such horses as have been standing in the stable for two days or more, and during that time consuming a large quantity of rich food; this fact is opposed to the hypothesis that sudden exposure to cold or a specific infection is the physiological factor in the disease. In Germany most cases are observed on the day after public holidays, but it would be quite unreasonable to suggest that at these times there is any special opportunity for the animals to catch cold.

Dieckerhoff thinks it is probable that the excess of albuminoids and carbohydrates which the animal has ingested, and which partly accumulate in the blood, partly in the organs, especially in the skeletal muscles, is of importance. Assuming that such accumulation has taken place, it may easily be imagined that slight or moderate exertion, such as the horses sometimes take even in the stable, will be followed by an abnormally great transformation of the albuminoids and carbohydrates. Such transformation may specially affect those muscles which are in an unusual degree exposed to strain, and it is well known that in the physiological metabolism of the skeletal muscles acids are formed (isomeric lactic acids, etc.). Dieckerhoff was therefore left to conclude that in hæmoglobinuria an abnormally large quantity of products with an acid reaction are formed in the affected muscles. It cannot be doubted that such products produced in excessive quantities must set up a painful irritation of the muscle parenchyma, and also that the absorption of very large quantities of such acid products from the muscles into the blood must lead to dissolution of a very large number of the red blood corpuscles.

Dieckerhoff maintains that this theory is in keeping with the well-known fact that in severe cases of the disease the muscular pain first begins to diminish from the third to the fifth day, and that the horse only recovers when the extensor muscles of the hind limbs are thrown into action in attempting to get up and in supporting the body in the standing posture. During muscular activity a much larger volume of blood passes through the muscles, and the metabolism is therefore then more active than in the state of rest. It may hence be assumed that when the muscles are thrown into action the irritating metabolic products are more quickly removed by absorption; the gradual removal of these products from the muscles leads to a remission of the painful affection in the muscle parenchyma. When the muscles of the limbs that are indispensable for supporting the animal in the standing posture, especially those of the hind limbs, are severely affected by the parenchymatous inflammation, the animal dies from the complications of the disease before resolution has had time to take place. In cases that recover the restoration of the muscles to the normal condition requires a long time, and special muscles, such as those attached to the patella, may undergo almost complete retrogression and remain functionless.

That in hæmoglobinuria the alkalinity of the blood is in a high degree diminished, and that the blood may acquire an almost neutral reaction, Dieckerhoff has often ascertained by the examination of blood withdrawn from the jugular of suspected horses. Through this observation he was led to try the effect of an alkali. He found that the object could not be attained by the intravenous injection of alkalies, and that it was necessary to resort to the internal administration of bicarbonate of soda. He has found that when large doses of the bicarbonate are administered recovery frequently takes place even in the severe cases, and from this he draws the conclusion that,

just as one can impart to the blood or the urine a high degree of alkalinity by the administration of large doses of bicarbonate of soda, so also this substance must bring about an alkaline reaction in the myosin of the affected muscles; and when once the acid metabolic products have been neutralised the irritation of the muscle parenchyma will disappear. In favour of this treatment it may also be observed that bicarbonate of soda has the effect of promoting the absorption of metabolic products.

Dieckerhoff admits that exhaustive chemical investigations would be necessary to enable one to decide whether this theory is correct or not, but he claims for it that it explains the circumstances, the symptoms, and the course of hæmoglobinuria, as well as the successful result of the treatment by bicarbonate of soda.

In a former article Dieckerhoff gave 150 to 300 grammes of the carbonate as the appropriate dose, but during the course of the last year he has ascertained that this is not sufficient to effect a cure in severe cases of the disease. Accordingly, after he had made some experimental trials on healthy horses, he was led to administer much larger doses, and he finds that even 500 grammes does not produce any injurious effect. Occasionally the animals drink a large quantity of water some hours after the administration of the carbonate, but frequently the thirst is not increased. In animals that are unable to get up the veterinary surgeon may administer the bicarbonate in watery solution, otherwise it may be conveniently given in the form of ball.

He thus describes the method of treatment which he now adopts. When the animal has been brought to the hospital in an ambulance waggon, it is put into a good loose-box, comfortably bedded, and a purgative is administered. Purgation is most quickly brought about by the intravenous injection of a solution of chloride of barium, of which, however, only a small dose (7 to 10 grains) must be given; instead of the chloride of barium one may give sulphate of eserin as a subcutaneous injection, or extract of aloes combined with sulphate of soda in mixture or in balls.

Immediately thereafter the horse is given 200 grammes of bicarbonate of soda with a large quantity of ordinary water; in small horses the dose may be proportionately reduced. Thereafter the administration of the bicarbonate in doses of 100 to 150 grammes is repeated every two or three hours, either in water or in ball. The total dose for twenty-four hours varies, according to the size of the horse, from 500 to 800 grammes, and in exceptionally large horses 1000 grammes may be given. On the second day the administration is continued with smaller doses, and also on the third day, provided the horse is still unable to get up, or cannot be supported in the standing posture.

Dieckerhoff maintains that in acute and chronic dyspepsia (gastro-intestinal catarrh of the horse and ox) the administration of large doses of bicarbonate of soda, up to 500 grammes daily, gives much better results than the treatment hitherto generally adopted. Larger doses than 500 grammes daily are not to be recommended, and smaller doses, such as 100 to 150 grammes, more frequently repeated, are better borne than the single large dose. But the maximum dose of bicarbonate of soda has not yet been ascertained; he gave to a medium-sized experimental horse on three successive days one pound of the bicarbonate daily, and on the fourth day he gave a pound and a half. This did not produce any apparent disturbance; the horse continued to eat as betore, or even with greater appetite, and the fæces were not altered either in quantity or quality. Four days afterwards the horse was given two pounds of the bicarbonate, and immediately thereafter it ceased to eat, scraped occasionally with the fore feet as if from slight colic, and the respiration was hurried, with symptoms of expiratory dyspnœa; the pulse and temperature remained normal. During the following fifteen hours there was abundant

discharge of urine, and thereafter the animal drank greedily two pailfuls of water; the appetite did not return for twenty-four hours afterwards.

The favourable effect of the administration of large doses of bicarbonate of soda in the treatment of hæmoglobinuria makes itself evident on the second or third day of the disease, and sometimes even earlier. By that time the animals have so far reacquired the powers of the muscles as to be able to support themselves for a short time on the sternum, and the appetite for hay and water is retained. From the twentieth to the fiftieth hour after the beginning of the treatment the horses are able to get up and bear weight for a short time on their hind legs. In the course of the next day the power over the extensor muscles of the hind limbs is greater, and the patients are now able to stand for a longer time. Success is the more easily attained the sooner treatment is begun in the course of the disease, and it is observed that in cases where the inflammation of the muscle substance has produced considerable tissue destruction a rapid cure cannot be looked for, and that in very severe cases recovery is impossible by any method.

Inasmuch as after the second day efforts to use the extensor muscles are beneficial, attempts should be made to maintain the animal in the standing posture, but according to Dieckerhoff's experience it is only in severe cases that it is necessary to sling the animal on the third and the two following days of the attack; in less severe cases treated by the bicarbonate of soda method the animals are able to stand of themselves. This is regarded as one of the main advantages of the treatment, inasmuch as hitherto by other methods one of the greatest difficulties has been to keep the animal on its legs.

From the 7th December 1895 to the 10th December 1896, Dieckerhoff has treated twelve horses that were brought to the hospital in the ambulance waggon. In these animals the attack dated from two to nine hours before they were brought in; all of them were treated by the above described method. One of them was an animal of such slight value that it was decided to have it killed, and another horse died on the third day in consequence of an accidental lesion. Of the other ten cases seven were severely and three slightly attacked, but all were cured. Even the severe cases, in which it was found impossible to keep the animal on its legs by means of slings, on the first or second day of the attack were able to rise without assistance, and to stand for a short time forty to sixty hours after they had been brought into the hospital. In the milder cases the patients were able to get up in from twenty to twenty-four hours after the beginning of the treatment.

In several of the ten cases the patellar muscles were unequally affected on the two sides; such animals put less weight on the leg that was most affected, but in consequenee of the frequent attempts to stand, and the movements in the stall, the severe affection of the patellar muscles disappeared in two or three days.

THE HEREDITY OF ACQUIRED IMMUNITY.

In the Annals of the Pasteur Institute for February 1896 there is an interesting article on the above subject by Vaillard. At the outset of his paper the author sets forth the very divergent views that have been put forward by different authorities regarding this question.

Numerous examples relating to the human subject and the lower animals show that the progeny of a mother immunised against an infectious disease may be born refractory to that particular affection. This fact has been observed in the following two circumstances.

First.—During the period of gestation the mother contracts a disease which

confers immunity, or she is submitted to a preventive vaccination, and the fœtus then shares the immunity acquired by the parent. Thus, it has been observed that the child of a woman who has been the subject of small-pox, even when it comes to the world without any visible signs of the eruption, is refractory to the virus of small-pox or of cow-pox; in the same way a woman successfully vaccinated while pregnant frequently gives birth to a child that is refractory to vaccination.

The immunity of lambs produced by ewes that have been vaccinated against anthrax during gestation has been recorded by Chauveau, and other authors have put on record similar observations regarding sheep-pox and black-quarter.

Second.—The immunisation of the mother dates from a period more or less remote from conception, and results from a chemical or bacterial vaccination practised with a prophylactic or experimental object, the last of the vaccinating injections having been performed a considerable time previous to impregnation. As in the preceding case, the fœtus may be born refractory to the disease against which its mother was protected; many observations made on laboratory animals establish this fact.

A clear distinction ought to be drawn between these two different cases.

When the immunisation of the mother is effected during pregnancy, as the result of natural infection or of a bacterial vaccination, the fœtus really participates in the disease of the parent. This participation is complete if the microbes have traversed the placenta; it is partial, but nevertheless efficacious, if the fœtus has received, not the virus, but the soluble products elaborated in the maternal tissues. One conceives that in the case of a chemical vaccination the soluble substances that are injected into the mother dialyse across the placenta and reach the fœtus; such circumstances have nothing in common with what one ought to understand by the term hereditary transmission of immunity; they are simply cases of simultaneous vaccination of the mother and the fœtus.

The cases of the second group, on the contrary, have all the appearances of the phenomenon of heredity, since the mother communicates to her progeny a property which she had acquired before conception. It is only to cases of this kind that the term hereditary transmission may be legitimately applied, and it is only with cases of this kind that Vaillard deals in his article.

Very divergent opinions having been emitted regarding the manner in which this acquired immunity comes about. At first it was supposed by some that the transmission to the fœtus of the refractory state acquired by the mother was governed by the laws of physiological inheritance. Thus, Duclaux says that "not only the mother, but also the father may transmit to the children intellectual faculties, moral qualities, physical resemblances, and even acquired deformities; the transmission of immunity does not require any other mechanism."

Very different from this is the opinion of Ehrlich, who was the first to bring experimentation to bear on this biological problem. Ehrlich studied the transmission of immunity in animals vaccinated against certain vegetable poisons (abrin), or against bacterial toxins (tetanus), and as a result of his researches, which were as remarkable for their precision as for their ingenuity, he arrived at the conclusions:—

The father never communicates immunity to his descendants; the mother only possesses this power.

The immunity of the new born animals is of very transient duration (three to four weeks), and is not self-transmitted from generation to generation. It results solely from the passage or transference of the antitoxic substance contained in the maternal organism; hence its disappearance with elimination of this substance.

Ehrlich concluded that the ovum and the spermatozöoid are incapable of transmitting immunity. There, therefore, could be no such thing as hereditary immunity in the strict sense of the word for like all other acquired properties, immunity is not transmitted.

Charrin and Gley also endeavoured to solve the problem by way of experimentation, and they arrived at conclusions which were opposed to those of Ehrlich, and which supported the cellular theory of hereditary immunity. They concluded not only that a vaccinated father might transmit immunity to his descendants, but also that normal females impregnated by an immunised male might thereby acquire an undeniable resistance to infection. In their view immunity was thus really hereditary, and this heredity would find its explanation in the transmission to the sexual cells of an attribute acquired by the somatic cells.

Tizzoni and Centanni arrived at similar conclusions as the result of experiments regarding rabies and tetanus, and to them it appeared that in the case of tetanus the immunity transmitted by the male was even more durable than that transmitted by the female.

To sum up, it may be said that if the aptitude of the mother to transmit the immunity could not be denied, there still remained profound disagreement regarding the *rôle* of the father; for, while Ehrlich altogether denied this, Duclaux and Arloing admitted it on theoretical grounds, while Charrin and others regarded it as experimentally demonstrated.

In view of these divergencies of opinions Vaillard thinks it opportune to publish the result of the experimental researches which he has for a number of years been engaged in carrying out upon this subject.

His experiments have been carried out on animals immunised against tetanus, cholera, anthrax, and the disease produced by the avicidal vibrio. Two species of animals have been submitted to experiment—the guinea-pig and the rabbit for tetanus, the rabbit for anthrax, and the guinea-pig for cholera and the avicidal vibrio. The methods of immunisation employed were those which are in daily use in the laboratories to vaccinate these rodents against the diseases mentioned. The methods were as follows:—

(*a.*) Tetanus. Progressively increasing injections of toxin modified by iodine; then active toxin.

(*b.*) Anthrax. The method described by Chamberland and Roux.

(*c.*) Cholera. Progressively increasing injections of cultures heated to 100° C.

(*d.*) Avicidal vibrio. Subcutaneous inoculations of graduated doses of virulent cultures.

In the case of tetanus and cholera the vaccinations were thus obtained by the use of the soluble products of the bacteria; while in the case of anthrax and the avicidal vibrio the effect was produced by the action of the living microbes themselves.

The animals were not allowed to breed until they had acquired a very high degree of immunity.

In the experiments bearing on the *rôle* of the father in the transmission of immunity, a number of males possessing an immunity which was well marked and well kept up were coupled as often as possible with normal females. The progeny of these animals were tested at intervals varying from five days to two months with doses of toxin (tetanus), or of virus certainly sufficient to cause death in control subjects.

Multiplied experiments of this nature showed that, no matter what the degree of immunisation, the progeny of a hypervaccinated father and a normal mother did not possess any power of resistance whatever. On several occasions the mothers were tested at the same time as their progeny, and with the same result, namely, to show that they had not acquired any protection.

In the experiments bearing on the *rôle* of the mother numerous hyper-vaccinated females were coupled with normal males, and in every such case it was found that the mothers had transmitted the immunity to their progeny. This transmission was not confined to the pregnancy which immediately followed the vaccination; it was observed for several subsequent pregnancies a long time after the cessation of the vaccinating injections, or, in other words, as long as the immunity of the mother persisted.

The experiments showed that in regard to tetanus a very high degree of immunity could thus be inherited, guinea-pigs of from three to fifteen days old being able to support doses of toxin 200 to 400 times greater than the dose fatal to control subjects. But in all cases the immunity was manifestly inferior to that of the female parent.

It was several times observed in the case of the tetanus and anthrax experiments that the immunity was not always equally shared by the animals of the same pregnancy, and occasionally it appeared to be entirely absent in one or two of a litter. This singular fact raises the interesting question whether in some cases some of the fœtuses *in utero* do not receive the hypothetical substance which confers the immunity, or whether, having received it, they have rapidly lost it after birth. Vaillard inclines to the view that the latter hypothesis is the correct one.

In his experiments bearing on this subject Ehrlich showed that in the case of mice vaccinated against the vegetable toxins the immunity transmitted to their progeny was very transient, and did not last more than three months. This observation applies also to other kinds of immunisation. The immunity is never durable in the descendants of mothers vaccinated against tetanus; it is very pronounced in the first two months after birth, but it afterwards declines, and ordinarily disappears from the third to the fourth month, although at this time the mother still supports without injury very large doses of toxin. The same is the case for anthrax also. It is this early disappearance of the inherited immunity which explains the fact that it is not transmitted from generation to generation, although in one instance Vaillard noticed a marked degree of resistance in a guinea-pig of the second generation.

It might be asked whether the vaccination of the mother during the course of pregnancy, that is to say, the vaccination of the fœtus during its development, would not render the immunity of the latter more permanent. Ehrlich has dealt with this question and cites an experiment in which, after having fed a mouse with ricin during gestation, he found that the progeny possessed a high degree of resistance to the intoxication as long as four months after birth. Ehrlich, however, refrained from drawing any conclusion from this single observation. Experiments such as would settle the question are difficult to carry out, because active attempts to immunise the mother during pregnancy often lead to abortion. However, in the case of two rabbits vaccinated in these conditions against tetanus Vaillard was able to observe that the immunity of the progeny was hardly more durable than the preceding; it did not last longer than from three to five months.

It therefore appears that the immunity acquired *in utero* is ordinarily of short duration, and Vaillard remarks upon the great difference in this respect between the immunity contracted before birth and that acquired afterwards. In the experiments of Rickert on sheep-pox the lambs born of mothers vaccinated during gestation were found refractory up to thirty or forty days after birth; when tested three years later they all contracted sheep-pox, while sheep of the same age, born of normal mothers but vaccinated after birth, still retained their resistance after the lapse of a similar period.

To explain the transient nature of the immunity acquired *in utero*, Ehrlich supposed that the tissues of the embryo are much less sensitive than those of the mother to microbian products. Schreiber's experiments on the absence

of reaction to phenomenal doses of tuberculin on the part of newly-born animals show that the irritability of the embryo with regard to bacterial products may be quite different from, and much less than, that of developed organisms. But immunity results from the reaction of the body against these products, and the moment that the specific irritability is lacking its effect, that is to say immunisation, will also be lacking in the embryo, although the same agent that immunises the mother circulates in the tissues of the embryo. Vaillard remarks that this hypothesis appears to be in accord with the observed fact.

Ehrlich distinguished two sorts of immunity. The one is *active*, stable, and persistent, corresponding to a condition of an organism which has become apt to produce an antitoxic or germicidal substance; it is this sort of immunity which vaccination provokes in the mother. The other is *passive* and transient, and results from the introduction into the body of an antitoxic or germicidal substance; the type of this kind of immunity is furnished by the transient resistance which the injection of antitoxic serum communicates to animals. According to Ehrlich, this second form of immunity is the only one which appertains to the progeny of a vaccinated mother. Its mechanism therefore consists entirely in the passive transmission to the embryo of defensive substances prepared by the mother, or a passive transference which commences *in utero* and is continued after birth through absorption of the antitoxin contained in the maternal milk. This latter notion is one of much interest, and the grounds on which Ehrlich was led to adopt it were as follows.

Starting with the hypothesis that the descendants of an animal vaccinated against ricin owe their refractory state to the maternal antidote, Ehrlich was struck with the difference which exists between the ordinary duration of their immunity (five to eight weeks) and that of the immunity produced by the injection of antitoxic serum (thirty-four to thirty-nine days). It thus appeared that the quantity of antiricin received *in utero* was not sufficient to continue the immunity of the new-born animals to its ordinary term, and that the young animals somehow continued to receive the antidote after birth. For this the milk appeared to Ehrlich to be the only admissible vehicle, and some ingenious experiments which he made with normal mice and others immunised against abrin or ricin bore out the correctness of the hypothesis. Other experiments made on mice with tetanus and swine erysipelas yielded a similar result.

Ehrlich therefore inferred that of the two factors which come into play in the production of hereditary immunity, namely, fœtal saturation and immunisation by means of the milk, the second plays a much greater *rôle* than the first. Its share in the process is so marked, and its action is so prompt, that in order to immunise mice against tetanus it suffices to nourish them from forty-eight to seventy-two hours with the milk of a mother into which some antitetanic serum has been injected.

Without furnishing proof of the fact Ehrlich implicitly admitted that the blood of the progeny of a mother immunised against tetanus is antitoxic. Vaillard's own experiments do not go to show that this is a general law. He finds that the antitoxic condition of the blood is frequent in rabbits born of vaccinated mothers, but it is not constant; on the other hand, some rabbits whose serum does not appear at all antitoxic resist the tetanus poison, while others whose serum is slightly antitoxic succumb under the action of feeble doses. Hence, it appears that the antitoxic power of the humours does not represent the essential condition of the immunity of the progeny, since it may be altogether absent in subjects recognised refractory, and may exist in others which are not so.

Vaillard also has made some experiments bearing on the part which is played by the milk in the immunisation of young animals. His researches

have related only to tetanus, and he remarks that the passage of the tetanus antitoxin into the milk of immunised females is a fact which is constant and easy to verify in all species of animals, mice, guinea-pig, rabbits, etc. In the case of mice he has been able to verify Ehrlich's observation that the injection of antioxic serum to a normal mouse suffices to confer immunity on the progeny which it suckles, but, while this is true for the mouse, Vaillard finds that it ceases to be true when one comes to other species of animals. For example, guinea-pigs born of a normal mother do not acquire any appreciable resistance from the fact that they have been suckled by a hypervaccinated female, and a guinea-pig born of a vaccinated mother does not seem to lose any of its original immunity when it is nourished by a normal female; its resistance is equal to that of animals of the same litter suckled by their own mother. Experiments on rabbits have yielded similar results.

The theory of Ehrlich is not confined to cases in which the vaccination provokes the formation of an antitoxic substance. It takes account of all the facts, and supposes that, according to the requirements of the case, the descendant may receive from the mother either the antidote of the poison or the germicidal substance which preserves against infection. But there are some immunities in which one cannot suppose the existence of any germicidal or antitoxic property in the humours. Vaillard found that rabbits vaccinated against anthrax communicated to their young a certain immunity; this immunity of the young was certainly not due to the existence of a preventive substance in their blood, for the parents did not present the degree of immunisation necessary for the appearance of this property, and their serum employed in large doses did not manifest any preservative power. The mother could not transmit to the progeny that which she did not herself possess, and the immunity of the latter must therefore have been due to some other condition than the germicidal or preventive property of the blood. This other condition, which Ehrlich overlooked, is the aptitude of the phagocyte cells to ingest and immobilise the virus.

Two parts are to be considered in the theory of Ehrlich regarding hereditary immunity. The one establishes that the sexual cells do not take any part in its transmission, and of this Vaillard's observations furnish a new proof; the other formulates the mechanism by which the mother communicates to her progeny the refractory state, and makes this exclusively depend upon the existence in the new-born animals of antitoxic or germicidal substances derived from the mother. Vaillard maintains that this theory is too much inspired by the humoural conception of immunity, and that therefore this part of the doctrine presents defects and imperfections on account of which it cannot be considered as a complete expression of the truth. It was based on an exact observation, but an observation which was correct only for a particular case, and it accords to the milk a general *rôle* which does not belong to it.

According to the theory of Duclaux and others hereditary immunity depends essentially upon the transmission of a cellular attribute. If the progeny are protected like the parent the reason of it is, say Charrin and Gley, that the cells have received the phagocytory aptitude through the intermediation of the parent cells of the leucocytes, or rather, that the power of producing antitoxic or germicidal substances has been infused into them like other functions by the ovum and the spermatozöoid.

But, according to Vaillard, the incapacity of the male to communicate the refractory state furnishes the proof that the source of transmitted immunity cannot be sought in a legacy of the sexual cells. Hence, he says, there is no need to go back to the act of conception or of impregnation to grasp the moment when the mother confers immunity; this occurs subsequently, and dates from the instant when the impregnated ovum commences its

evolution in the uterus. From the beginning of its development up to its birth the fœtus is nourished and grows at the expense of soluble materials in the maternal plasma, and with these it is constantly impregnated. Perhaps the exchanges are not limited to the dialysis of soluble products; the placental membranes are frequently traversed by bacteria, and they may also allow the passage of motile cells of the maternal blood (various facts demonstrate the reality of this leucocytary emigration). An explanaticn of the phenomenon must be sought in one or other of these conditions, that is to say, the action of the plasma or of the cells of the mother.

The observations and experiments hitherto made justify the following conclusions: *First*, the mother only is in a position to communicate immunity to her progeny; *Second*, the father never transmits immunity to his progeny; *Third*, the immunity received from the parent is always of brief duration; it is retained only during the first months of life.

These conclusions are in opposition to the *rôle* attributed to the so-called hereditary immunity in the general history of the infectious diseases of the human subject. It has been attempted to explain the decreasing malignancy of certain diseases in the course of centuries as the result of the formation of immunities or resistances hereditarily transmitted, and the same explanation has been offered to account for the unequal gravity of a disease in the various subjects in a single community, and also for the progress and the varying fatality of epidemics according to the medium in which they break out. But the sphere of action of hereditary immunity is already restricted by the fact that of the two parents only one is capable of transmitting it, and its effect is still further diminished by the fact that it soon disappears, its preservative influence not being extended beyond the first months of life. It ought further to be added that this transmission of maternal immunity probably does not take place so frequently in the human subject as some have supposed. In experimentation one is obliged to have recourse to hypervaccinated animals, in which the immunisation is carried to a degree such as is never conferred by a single attack of the infectious malady, and since even in these circumstances the transmitted immunity is very transient it is likely to be still more fleeting in natural cases.

TUBERCULOSIS.[1]

REPORT by GERMAN SIMS WOODHEAD, M.D., Director of the Laboratories of the Royal Colleges of Physicians (London) and Surgeons (England).

THE object of the inquiry, as laid down in the recommendation by the Royal Commission, was "to determine how far cooking processes destroy the infectivity of tubercle."

"Using for this purpose demonstrably tuberculous material, taken as milk, flesh, or organs, and proved always by control experiments to be infective to susceptible animals."

"To find under what circumstances of cooking each specimen may be deprived of its power of infecting susceptible animals fed with it, and to define the limits of the conditions for effectual disinfection by cooking processes."

In order to collect fairly complete data from which to argue and obtain definite answers to the various questions raised in the "enquiry as to how far cooking processes destroy the infectivity of tubercle," it was necessary to carry on a considerable number of collateral experiments under carefully defined conditions, care being taken to eliminate as many sources of error as

[1] From the Report of the Royal Commission appointed in 1890 to inquire into the effect of Food derived from Tuberculous Animals on Human Health.

possible. It was at first thought that it would be necessary to use a large number of different species of animals, but after a series of preliminary experiments had been carried on, it was concluded that guinea-pigs, cats, and pigs would serve the purpose best, not only because they could be most conveniently obtained, but also because they would give the most reliable results. Guinea-pigs were taken as representing the herbivora, cats the carnivora, and pigs the omnivora.

FEEDING AND INOCULATION EXPERIMENTS WITH RAW OR PLUNGED MEAT TAKEN FROM COWS WITH MILD, MODERATE, OR ADVANCED TUBERCULOSIS.

The object of this part of the investigation was to ascertain whether the raw meat of tuberculous cows was capable of producing tuberculosis in animals fed or inoculated with it, in order to control what might be obtained in connection with the feeding and inoculation experiments made with boiled or roasted meat taken from the same or similar tuberculous cows.

The meat used was taken:

(*a*.) From the neighbourhood of tuberculous glands;

(*b*.) From beneath the costal pleura, where such pleura was visibly affected with tuberculosis;

(*c*.) From the muscles of the abdominal wall where there was tuberculosis of the parietal peritoneum;

(*d*.) From beneath the healthy pleura or peritoneum of animals in which the tuberculosis was confined to the visceral organs, and to the glands connected with them.

In the course of these experiments the meat from twenty-six carcases of tuberculous cows was obtained, but in several cases it was forwarded in such a condition and so packed in contact with tuberculous organs and parts that it was decided not to use it for raw meat experiments.

Nineteen carcases were obtained in such good condition and had been removed and transported with such precautions that they could be used for experimental purposes.

After careful examination of the carcase, the butcher was requested to dress it in the ordinary way, the pleura being removed and the organs taken out as carefully as possible; the cervical, lumbar, and popliteal glands were examined, and then portions of meat were cut out as directed. The joints used were sirloin, outlift, buttock or rump, inlift or inside of the thigh, intercostal muscles—in some cases with the muscular part of the diaphragm attached—these being removed with several ribs, the muscles of the abdominal wall and the shoulder. In two cases the tubercular pleura was not stripped from the inside of the chest, but was left attached to the ribs and intercostal muscle and was cut in one piece from the chest wall. As most of these joints were obtained for cooking purposes they were cut in as solid blocks as possible in order that the centre of the joint might be some distance from the surface.

The meat that was used for these experiments may be classified under two headings, viz.:—

(1.) Raw meat which, although it might have been accidentally contaminated during the processes of killing, dressing, and cutting up was given (after mincing) to the animals just as it came from the butcher without treatment of any kind.

(2.) Plunged meat; that is, meat kept in boiling water for five or ten minutes in order that the possibility of infection from any such accidental contamination as above described might be eliminated. Here the thin outer discoloured layer was cut off with sterilised knives, and only the raw central portion was used for feeding and

inoculation purposes. In this manner all risk of external contamination was entirely done away with, whilst the central part retained for the experiments remained unchanged.

The minced meat was, in the earlier experiments, mixed with meal, bran, or chopped green food, but in the later experiments, in order that there might be as little *dilution* of the material as possible, it was given without any such admixture. The quantity given varied very considerably; in some cases the meat would not keep nearly so well as in others. The average amount received by each guinea-pig was about 150 grammes (equal to about one-third the weight of the animal), but a few received less than 100 grammes. Cats received about the same proportional weight to their body weight, but in the case of pigs the proportion varied very considerably and had to be determined by the amount of meat available.

In addition to the feeding experiments subcutaneous inoculations were made. In the subcutaneous inoculation experiments, a fragment of meat about the size of a small bean was inserted under the skin of the abdomen in the region of the groin; this fragment was cut from the surface of the raw meat or taken from the centre portion of the plunged meat, according to the nature of the experiment.

Some of the meat that was used for experiments, *i.e.*, that taken from animals that died, or were actually dying (when they were slaughtered to relieve them from a lingering death) from tuberculosis, would undoubtedly have been condemned as unfit for human food on account merely of its physical condition. An inspector would have described much of it as sodden, pale, and watery, especially where the tuberculosis had become generalised and where the emaciation of the animal was very marked during life. On the other hand much of the flesh, even of that taken from the neighbourhood of tuberculous glands, was still in fairly good condition as far as naked-eye appearances were concerned. In those cases, however, from which positive results were obtained, there was emaciation of the animal, accompanied by pallor of the muscles and some œdema of the connective tissues, not only between but around the muscles, in fact in almost every part of the body, but the meat would not, in all cases, have been condemned on this ground.

One most important feature in these "plunging" experiments is that in only a single case where the meat was, as a preliminary procedure, plunged into boiling water for a few minutes (so that the evil effects of smearing, such as might have occurred during the process of dressing the meat, might be guarded against) was any tuberculosis set up either by feeding or inoculation. Even in those cases in which a few early isolated tubercular granulations or old and quiescent tubercle (?) were demonstrated in the muscular tissue no evil results ensued, and it would appear that in both these cases there must have been some special reason that the tuberculous material in those meats was innocuous.

Although in a small number of cases tuberculosis was developed as the result of the ingestion or inoculation of raw meat from tuberculous cows, infection only occurred where the meat from animals that had been affected with advanced and generalised tuberculosis was used; by carefully attending to the isolation of the raw meat from tuberculous cows it was possible in most cases to ensure its absolute freedom from any specific infective material. In the case of cows suffering from mild and moderate tuberculosis this was a comparatively easy matter when proper precautions were taken, as in the whole series of experiments not one single positive result was obtained from meat taken from such cows.

With the meat taken from cows with advanced or generalised tuberculosis it was found in some cases to be impossible to obtain meat with its surface uncontaminated by the infected material, even when the strictest precautions

were taken to prevent the smearing of such meat with the juice or fatty or caseous matter of tuberculous foci or areas. With the raw meat taken from two cows, in which the tuberculosis was undoubtedly far advanced, positive results were obtained in the case of a pig and of a series of guinea-pigs, and in both inoculation and feeding experiments. That it was usually due to smearing there was strong presumptive evidence in the fact that where the surface was sterilised by the suspected meat being plunged into boiling water before it was used for experimental purposes, the results were, with one exception, negative.

In these cases of advanced and generalised tuberculosis Dr Woodhead was fully prepared to meet with a much larger number of positive results than were actually obtained; it must be remembered, however, that the number of animals passing through his hands for experimental purposes was comparatively small, and that even to have obtained a small percentage of positive results indicates that there is a real danger of infection not only from the tuberculous carcases themselves, but also from the joints of healthy cattle, joints that have been cut, handled, or wiped with knives, hands, and cloths that have been used for the dressing of tuberculous animals.

Tubercle granulations and caseous masses were actually found in the flesh of two cows used for experiment, and although in one case these granulations were only microscopical in character, and only a very small number of tubercle bacilli was present, their presence at all in these cases indicates the possibility of a similar condition occurring in a larger number of cases. It is, therefore, evident that the greatest care must be exercised by inspectors not to allow meat subject to such contamination to be sold for consumption.

It is held that where there is any naked-eye evidence of tubercle in any part or organ such part or organ should not be utilised as food; the other organs not obviously affected but in the same cavity as the affected organ should also be condemned as unsuitable for food.

Although the results obtained in every case by both feeding and inoculation with the tubercular flesh from the animals affected only with mild or moderate tuberculosis, and injected with tuberculin, were negative, similar lesions in glands and organs being capable of producing tuberculosis, we should be running a grave risk in recommending that the flesh from tuberculous cattle in which Koch's tuberculin has been used be allowed to be put on the market. In the two specific cases the flesh did not apparently contain sufficient infective material to produce tuberculosis either by feeding or by inoculation in guinea-pigs, although the flesh from other animals in which no evidence of tubercular lesions could be demonstrated in the flesh was, when given in the raw condition, quite capable of producing tuberculosis in either manner.

Although the number of experiments carried out under this head of the inquiry was comparatively small, the results obtained all point to the fact that although the danger arising out of the presence of these demonstratably tubercular lesions in the flesh is considerable, such danger is comparatively slight compared with that which arises out of the infection during the dressing of the animal of the whole of the surfaces of the "joints" that are prepared. These smeared surfaces come in contact with the tables, knives, and hands, not only of those who actually dress the animals but also of those into whose charge such meat afterwards passes. This is a source of extreme danger, especially in the case of cows in which the disease is generalised and advanced, and in which there are tubercular masses in the glands and organs, and actively growing grapes, and other tubercular growths on the serous surfaces on the abdominal and thoracic walls; all such masses contain numerous tubercle bacilli and form foci of infection so widely disseminated that the animal cannot be cut up or dressed without the knives, etc., cutting through and coming directly in contact with infective material.

On these grounds Dr Woodhead is decidedly of opinion that all animals suffering from advanced and generalised tuberculosis, whether cow, calf, or pig, should be condemned without any reference to the condition of the flesh. It is only rarely that the flesh from such cows would not be condemned on other grounds, and taking into consideration the small number of cows in which there could be any doubt and the expense entailed in subjecting the surface of such meat to the action of boiling water, before it should, under any circumstances, be allowed to be removed from the slaughter-house, it seems to him to be advisable, considering the great danger that must always accompany the use of such meat, to strongly recommend the complete destruction of these carcases.

Taking into consideration also the fact that Koch's tuberculin had been injected into the only two animals in which a trace of tubercle was found in the muscles, he agrees with Dr Martin that any animal in which tuberculin has been used for diagnostic purposes during life, if found to be suffering from tuberculosis after death, should not be utilised for food, but should be rigorously condemned and destroyed.

It may be laid down as a general rule that no part of the flesh of an animal near which there is even a localised tubercular lesion, whether in an organ, a gland, or a membrane, should be passed as food fit for immediate consumption. On this ground he is of opinion that where it is found that several glands in various parts of the body and widely separated are distinctly affected, the carcase, except in very rare cases, should be condemned as unfit for human food, and although when only one cavity, or the organs of one cavity are the sole parts affected, the bulk of a carcase may be passed, no parts over which the serous membrane is tubercular should ever be passed.

It would be advisable to give inspectors instructions that when the organs not usually affected, except in generalised tuberculosis (such as the popliteal, lumbar, and axillary glands) are affected, and there is any doubt in his mind as to whether the carcase is fit for human food or not, he should condemn the carcase rather than give it the benefit of the doubt.

Coming to the practical outcome of information gathered from the experiments with raw and cooked meats, Dr Woodhead recommends that every animal be inspected before it is killed by a veterinary surgeon working in conjunction with the medical officer of health; that wherever on such examination the presence of tuberculosis is suspected, the animal should be taken to a separate abattoir kept for the purpose: that no animals should be slaughtered in any but licensed slaughter-houses, and should there be killed and dressed by men specially instructed for such work; that if in the general work of the abattoir, any tubercular lesions are found in an animal, the chief inspector should be immediately called before the process of dressing is continued, and that he should order the animal to be taken to the special department for the cutting up of such animals, and that he shall there direct what is to be done with the affected carcase: that from such carcases as are not totally condemned the affected parts should be cut out whole before the meat is further dressed, and that such dressing should be carried on with knives from time to time placed in boiling water; that in order to ensure efficient inspection of the organs and parts of an animal affected with tuberculosis, all animals should be condemned where any attempt has been made to hide the presence of disease by stripping off the pleura or peritoneum, especially where the organs have not been kept for examination, and where the glands have been removed before the inspector has been called to examine the carcase. It is unnecessary to say that all organs and parts condemned should be thoroughly sterilised or destroyed out and out, and that even when sterilised should not be allowed to be used for food of any kind. As, however, boiling destroys the virulence of tubercle bacilli it may be suggested that arrangments might be made for

extracting the fat and gelatine by means of this process (or by the use of superheated steam) from condemned material, after which extraction the remainder of the material might be used for manure or treated by distillation.

As the experiments with plunged meat gave only one positive result he would recommend that in those cases where part of the carcase only is condemned the remainder should be plunged in boiling water for five or ten minutes; this would not in any way interfere with the nutritive value of the meat; it would have the additional advantage of sterilising absolutely the outer portion of the meat through which, as his experience shows, the meat would keep in a sweet condition for a longer time than if left unplunged, and it would naturally do away with the danger to be apprehended from ordinary accidental contamination of other meat. It would be a guarantee equal to a stamp mark that the inspector considered it suitable for human food when so treated, and would, in consequence, enhance the value of what in Germany is looked upon as very inferior meat.

FEEDING AND INOCULATION EXPERIMENTS WITH COOKED MEAT FROM TUBERCULOUS COWS.

This part of the investigation was carried out for the purpose of determining whether boiling and roasting the meat from tuberculous cows would render it innocuous, when used for feeding, and secondly to determine by inoculation experiments whether the tubercular virus, although rendered incapable of producing tuberculosis through feeding, still retained its power of acting on the unprotected tissues when introduced into them by means of inoculation.

In the first instance, as we have seen, it was necessary to determine whether the flesh from the tuberculous animals had any infective power when it was inoculated into, or ingested by, pigs, guinea-pigs, or cats. As these control experiments necessarily occupied a considerable time, and as it was necessary to use the flesh from the same animals in both cooking and control experiments, it was evident that the cooking experiments must be carried on at the same time as the controls.

The actual temperature attained in the meat was determined either by means of thermometers or by fusible metal (of various melting points) placed at different distances from the surface of the joint.

As it was essential to determine whether meat as ordinarily sent to the table was capable, when taken from tuberculous cows, of producing tuberculosis either by feeding or inoculation, the cooking experiments were carried out in the same fashion as cooking is done in the kitchen.

In the boiling experiments, the meat was simply put into boiling water in a tin vessel, in most cases covered with a lid in order that the whole of the meat might be exposed to water or steam at boiling point, great care being taken to keep the water constantly boiling, over a large Bunsen burner. The ordinary rule adopted by the housewife of giving a quarter of an hour's boiling for each pound of meat was usually adhered to; variations, however, were made on both sides of this limit.

Experiments were made with the meat from eleven cows, ten of which were used for feeding experiments, two for both feeding and inoculation experiments, and one for inoculation experiments only.

The results of these experiments may be summed up as follows:—Of fifty-six animals (all guinea-pigs) fed with boiled meat from ten cows not one developed the slightest trace of tuberculosis, but it must be observed that of thirty-one control animals fed with meat from the same cows, every one remained perfectly healthy, while Dr Martin, carrying on a similar series of experiments with raw meat, obtained only one positive result out of twenty-four animals fed.

In the inoculation series (a comparatively small one) only six guinea-pigs were inoculated with boiled meat taken from three cows; three died before the tubercle, if present, had time to manifest itself, and the other three were unaffected, whilst of six control guinea-pigs, inoculated with raw meat, two died too early to be taken account of, three were unaffected, and one was tubercular. Dr Martin, carrying on a similar series of experiments with raw meat, obtained positive results in four animals out of seventeen.

In the roasting experiments the meat was, in most instances, exposed to the heating process for twenty minutes per pound weight instead of fifteen minutes as in the case of the boiling experiments. The meat from twelve cows was used after it had been roasted; forty-eight animals were fed on this meat, but not one developed tuberculosis. There were thirty-four control animals fed on raw meat from the same cows, and here again not a single one developed tuberculosis. Dr Martin, however, feeding twenty-six animals, obtained positive results in three of them.

In inoculations of roasted meat from three cows, of seven guinea-pigs experimented on, not one developed tuberculosis, and seven control guinea-pigs inoculated with raw meat all escaped infection. But of Dr Martin's fifteen inoculations with raw meat from the same cows, four contracted tuberculosis.

The comparatively large number of positive results obtained in Dr Martin's series of experiments indicates beyond possibility of doubt the presence of infective material in the meat as it was sent out from the slaughter houses, and shows that extreme care is necessary in the after treatment of the meat in order to render it innocuous, for it must be borne in mind that we have to guard against affecting not only healthy individuals, but those, both children and adults, suffering from catarrhal or other affection—disease or injury—of the alimentary tract, in which the mucous surfaces are so altered that any tubercular material applied to them bears much the same relation to them that inoculated material bears to the unprotected tissues into which it is introduced. It is for this reason that throughout these experiments such stress is laid on the absolute necessity of determining not only whether the tubercular material was capable of infecting a healthy animal through feeding, but also whether it remained, though with its virulence diminished, sufficiently active to produce tuberculosis by means of inoculation.

Out of 114 animals fed or inoculated with meat subjected to cooking, by boiling or roasting, taken from fifteen cows, not a single one contracted tuberculosis. Meat from the same animals was not always used in both boiling and roasting experiments. Of 158 animals treated in a similar manner with raw meat from the same cows, thirteen became tubercular. The positive results were obtained almost entirely from cows in an advanced and generalised stage of the disease. The percentage of positive results obtained by inoculation experiments were to those obtained by feeding as 20·9 to 3·47.

FEEDING AND INOCULATION EXPERIMENTS WITH MANIFESTLY TUBERCULOUS MATERIAL—GLANDS, LUNG, UDDER, ETC.

Having determined the nature and degree of the danger to be anticipated from the use of tuberculous meat, and taking into consideration the fact that under certain conditions tubercular glands might accidentally be left in the joints of meat, or that tuberculous material might be carried in by the butcher's knife during the process of cutting up the meat, taken from tuberculous animals, it was considered necessary to find out the degree and nature of the danger arising from the use of tuberculous material, and of determining how such material of known infectivity could be rendered innocuous. As a first step towards a solution of this question, a series of cooking experiments with manifestly tubercular material—glands, lung, udder, etc.—was carried out. In

this series of experiments portions of obviously tubercular organs or glands taken from nine cows, and one phthisical lung (in all of which tubercle bacilli were easily demonstrated), were used as material for feeding and inoculation after they had been subjected to boiling or roasting.

Of forty-one animals (forty guinea-pigs and one pig) fed on obviously tubercular material that had been subjected to boiling, obtained from eight tubercular cows and one tubercular human lung, only four developed tuberculosis, whilst of eighteen animals (one pig and seventeen guinea-pigs) fed on raw material from the same source, fourteen developed tuberculosis. In all these cases where positive results were obtained the material had been cooked for a shorter time than that allowed by cooks in the kitchen. In each case the infective material was lung, which is exceedingly voluminous in proportion to its weight; in addition to this the caseous material which it contained was somewhat deeply imbedded in its substance, and was surrounded by a dense fibrous capsule. The slices of udder and glands, and even some pieces of lung subjected to boiling for a longer time, were invariably non-infective.

In the inoculation experiments with boiled tuberculous material, only two out of sixteen guinea-pigs became tuberculous, one infected with material from a thin slice of the udder, the other from a piece of caseous tubercle from the lung. The control inoculations gave eleven positive results out of twelve animals experimented on.

Of the two sets of experiments made with roasted tubercular material taken from two cows in an advanced stage of disease, three guinea-pigs, out of five animals fed, developed tuberculosis, whilst of three animals fed with raw material of a similar nature and from the same cows, two became tubercular. Raw tuberculous glands contained the most virulent material that was ever obtained in solid form; when roasted this material still remained infective. Material from tuberculous lungs also, though not giving the same number of positive results when ingested or inoculated raw, could not easily be rendered innocuous by cooking. In this series there was only one case in which the lung was roasted. The roasted lung proved non-infective both as regards feeding and inoculation. Eleven out of twelve control guinea-pigs inoculated with the raw tuberculous material from the same sources developed tuberculosis at an early date.

Out of sixty-three animals fed or inoculated with cooked tubercular material of various kinds only nine, or 14·2 per cent., became tubercular. Of those inoculated, two out of seventeen, or 11·7 per cent., became tubercular, whilst of the animals fed, seven out of forty-six, or 15·2 per cent., became tubercular.

When raw tubercular material from the same sources was used for feeding and inoculation, twenty-seven animals out of thirty-three, or nearly 81·8, were affected. Of the inoculated animals, eleven out of twelve animals, or 91·6 per cent., succumbed to tuberculosis, whilst of the animals fed, sixteen out of twenty-one, or 76·1 per cent., were attacked.

One point brought out by this set of experiments is that where obviously tubercular material (that is material containing a considerable number of tubercle bacilli, of course in a virulent form) is used, not only is the percentage of the animals affected in both feeding and inoculation experiments large, but the percentages of positive results obtained by these methods approximate much more closely than when the active infective agent is present in smaller numbers or quantities; this, of course, is what one would expect, as the extreme limit of infectivity is more and more nearly approached.

The second point is that the most deadly tubercular material can be rendered absolutely innocuous so far as any spreading infective disease is concerned by the action of a temperature at which water boils. There is evidence that a lower temperature than this is sufficient to bring about the same results when allowed to act for a longer time, but boiling for an instant even renders

the tubercle bacillus absolutely innocuous; it must be borne in mind, however, that each separate part of the tuberculous material must be subjected to the direct action of the boiling temperature in order that its activity may be completely destroyed, for, as in the case of the slices of udder half-an-inch thick, subjected to five minutes boiling, the central portion, though no longer capable of producing tuberculosis when taken into the alimentary canal of a guinea-pig, was still capable of setting up the disease when inoculated into the subcutaneous tissues, whilst the lung, boiled for fifty minutes only, still remained infective, in a remarkable degree, even when used for feeding purposes.

FEEDING AND INOCULATION EXPERIMENTS WITH MEAT RENDERED INFECTIVE BY THE ADDITION OF OBVIOUSLY TUBERCULAR MATERIAL.

These experiments were carried out for the purpose of ascertaining what would be the fate of obviously tubercular material present in the substance of meat during the process of cooking.

The experiments made were of two kinds. In the larger number of these experiments a piece of sirloin was obtained from a local butcher; from this sirloin the butcher was requested to remove the bone. It was then cut into a strip of from 18 inches to 24 inches long and varying in thickness from 1 inch to 1½ inches; this was laid out on a table and small incisions were made over the whole of the upper surface. An emulsion of obviously tubercular material was prepared by grinding and pounding down tubercular organs from cattle, pigs, or guinea-pigs, mixing this with milk and passing the mixture through a fine sieve, the part kept back being again ground and pounded until it would all pass through. This emulsion was thoroughly rubbed into the incisions and over the whole surface of the meat, which was then rolled up from one end, so that layers of finely divided tubercular material were enclosed at different distances from the surface; this roll was then firmly bound in all directions with string, so as to prevent, as far as possible, the access of boiling water between the layers.

The prepared roll was then cooked for a period corresponding to its size, usually a quarter of an hour for each pound weight in the boiling experiments, and twenty minutes for each pound in the roasting experiments. Pieces of fusible metal of different melting points were in some cases introduced along with the tuberculous material between the layers of the meat, whilst in other cases thermometers were pushed for different distances into the substance of the roll and then tied firmly in position, in order to prevent the water or fat filtering along the side of the stem of the thermometer down to the bulb.

In a couple of experiments, one boiling and one roasting, the tuberculous material was introduced 3 inches from the nearest surface, and as near the bone as possible, by means of a glass pipette into a block of meat. The opening made by the pipette was then carefully closed by means of a slip or plug of meat, which was held in position by a pin or skewer firmly bound with string, so as to press together the opposed surfaces along the incision.

In both methods of infection the quantity of tuberculous material introduced was considerably greater than would probably ever be present as the result of accidental contamination, but the results as regards the action of heat on the infective material were exactly the same as would be obtained in the ordinary process of cooking, and the larger quantity was used merely in order that one might make more sure of obtaining a sufficient quantity for experimental purposes when the joint came to be opened up after it had been cooked.

This series of experiments showed that the temperature attained in the centre of a roasted or boiled roll is not sufficient to render the contained tubercular material innocuous when given as food; this fact is even more

strikingly accentuated when the material is used for inoculation or injection experiments.

The tubercular material with which the meat was smeared contained so many bacilli that it was deemed quite unnecessary to make any special control inoculation experiments; and 90 per cent. of the animals fed with the raw material developed tuberculosis.

Out of seventy-four animals to which the boiled or roasted smeared meat had been given, either as food or in the form of subcutaneous inoculation or intraperitoneal injection, twenty-eight animals, or over 37·8 per cent., developed tuberculosis; whilst of the twenty control animals fed (it was not considered necessary to make any control inoculation experiments) with the raw virulent material, eighteen animals, or 90 per cent., became tubercular.

From these experiments it is evident that if tubercular material is left adhering to the meat that is afterwards rolled (a method of dealing with meat, especially meat of inferior quality, very commonly resorted to) roasting and boiling as ordinarily carried out cannot be relied upon to destroy its infectivity. The reason for this will be gathered on reference to the results of the experiments obtained with meat into which pieces of fusible metal and thermometers had been inserted in order to determine the actual temperature attained in different parts of these joints, the temperature being in most cases very much lower than one would have expected, even in cases where the meat appears from the cook's point of view to be thoroughly cooked.

A most important deduction to be drawn from these experiments is that if the peritoneal layer investing the thin muscles of the abdomen of the cow is affected with tuberculosis, the muscular wall should invariably be confiscated and destroyed. The danger of tuberculous glands remaining in solid joints and becoming a source of infection is *comparatively* unimportant, though should such gland be present in the centre of a joint it will be readily understood that it might prove a source of very grave danger.

It is evident that in the boiling and roasting experiments as ordinarily carried out in the kitchen, the temperature, however high it may be near the surface, seldom reaches 60° C. in the centre of a joint, except in the case of joints under 6 lbs. in weight. Ordinary cooking is quite sufficient to destroy any smeared material that remains on the outer surface of meat, *but it cannot be relied upon in the slightest degree to render innocuous the same smeared material when in the centre of a roll.* As these rolls are always subject to a good deal of handling and cutting during the process of making up, they are correspondingly more liable to contain such smeared material than ordinary joints, and the risk of their carrying infection is to that extent increased.

The least reliable method of cooking for this purpose is roasting before the fire; next comes roasting in an oven, and then boiling.

FEEDING AND INOCULATION EXPERIMENTS WITH MILK HEATED AT VARIOUS TEMPERATURES, TAKEN FROM COWS WITH TUBERCULAR UDDERS.

This investigation was planned with the object of determining the conditions of temperature that are necessary to render innocuous to animals milk taken from cattle with distinctly tubercular udders (and in which tubercle bacilli could be demonstrated by means of the microscope), either by feeding or injection into one of the serous cavities or into the subcutaneous tissues. In this series of experiments it was thought that the inoculations would assume far greater importance than in the case of infection by meat, for the reason that it was found in the earlier experiments that animals, pigs especially, that succumbed to tuberculosis after being fed with tubercular milk were frequently attacked through the tonsils as well as from other parts of the alimentary

tract. In some of the preliminary experiments, it was also found that milk heated to a considerably higher temperature than that to which it was found necessary to subject it, in order to render it innocuous to guinea-pigs by feeding, was still capable of setting up tuberculosis not only when inoculated intraperitoneally in the same species but also when brought in contact with the alimentary tract, especially the tonsils, of a different species, such as the pig. It was, in fact, concluded at a very early stage of the investigation that so long as this material remained capable of producing infection when introduced either into the subcutaneous tissues or into the peritoneal cavity, so long did it remain capable when ingested, of setting up infection in the pig, the infection in such cases usually commencing in the tonsils. As this method of infection was found to be so uniform, and as it corresponds so accurately with what is found to occur in scrofulous children, in whom the glands of the neck are so frequently affected by a tubercular lesion, the injection experiments assumed such importance that they were in all cases carried on at the same time as the feeding experiments, with the result, of course, that the number of experiments was very considerably multiplied beyond what in the first instance had been anticipated. It will be seen, however, that these injection experiments could not have been omitted if the report was to be complete, as in the majority of cases in which the heated milk was no longer capable of setting up tuberculosis in the guinea-pig, it still set up infection when injected into that species and when ingested in the case of the pig.

Experiments with Tubercular Milk.—This series of experiments was made entirely with the milk from four cows in which the degree of tuberculosis of the udder was so marked that there could be no doubt that if tubercular milk could produce tuberculosis this was suitable material with which to try the experiments.

In the first series of experiments the cold milk was poured into small glass beakers, which were at once placed in the inner compartment of the "steriliser," which had previously been raised to 70° C., the temperature at which the heating was to be carried out. As the milk was put in cold it was evident that the temperature attained was not, during the whole time that the milk was exposed to the heat, equal to that which was ultimately attained, *i.e.*, the temperature of the surrounding water. Indeed, it was afterwards thought that this might account for the tuberculosis that was developed in two guinea-pigs, injected with tubercular milk that had been exposed to a temperature of 70° C. for eleven or twelve minutes respectively in long narrow glass tubes, and in one guinea-pig that had been fed with similar tubercular milk heated to 70° for fifteen minutes.

This method being evidently open to objection as not being sufficiently accurate for the purpose, though it is the method that is most frequently used for domestic purposes, the milk, in succeeding experiments, was in the first instance rapidly heated (in a flask over the naked Bunsen burner for the higher temperatures and in a water bath for the lower temperatures) to the required temperature, 60°, 70°, or 80° C., as the case might be, a thermometer being kept in the milk during the process, and the milk being constantly agitated. This heated milk was then placed in beakers of from 50 to 300 cc. capacity, that had previously been heated to the required temperature by being plunged into hot water. When the milk had been heated up to the same temperature as the water in the steriliser, there was, of course, no object in having thin columns, such as were used when it was thought necessary to use milk introduced cold into the steriliser. The beakers were weighted at the bottom with lead, and filled to such a height that when floating in the water the level of the milk within the beaker was rather lower (from one quarter to one half-inch) than that of the surrounding water, and care was always taken in introducing the milk not to allow any of it to come in contact

with the lip or side of the beaker that would remain above water during the heating process; whenever such accidental contamination occurred the beaker was immediately re-sterilised.

In the first series of experiments the milk employed was described as a slightly purulent thick yellowish fluid on the first day on which it was used: on the following days it became much more serous in character until it could no longer be recognised as milk. It was of distinctly alkaline reaction, and when smeared on a cover glass and stained by the Ziehl-Nielsen method and examined microscopically it was found to contain a large number of tubercle bacilli. This milk was first heated up to 60° C., after which it was poured into beakers which had been heated up to the same temperature; samples were then maintained at that temperature for fifteen and thirty minutes respectively in the closed steriliser, after which they were rapidly cooled down to the temperature of the body by placing the beakers in cold water, before the milk was used for feeding and inoculation experiments. It contained such a large number of tubercle bacilli and was so evidently tubercular that only three control feeding experiments and three injection controls were made, all on guinea-pigs. That it was extremely virulent may be gathered from the fact that in every case, both of feeding and inoculation, positive results were obtained. In the control feeding experiments ulceration occurred with great regularity in both the large and small intestines where the raw tubercular milk had been ingested by guinea-pigs.

In the feeding experiments with tubercular milk heated to 60° C. (140° F.), for fifteen and thirty minutes the milk proved to be perfectly innocuous, as not one of the animals became infected, though this sample of milk had proved so uniformly fatal when given in the raw state.

In the injection experiments of the three guinea-pigs with raw milk from the same cow, out of three guinea-pigs one died on the seventeenth day, the second on the eighteenth day, and the third on the twentieth day after inoculation.

Injection experiments with the same tubercular milk heated to 60° C. (140° F.) showed that the tubercle bacilli in this milk were not rendered inactive by somewhat prolonged exposure to a temperature of 60° C., as two out of the three guinea-pigs injected with 1 cc. of the milk maintained at this temperature for fifteen minutes contracted tuberculosis, and of the three guinea-pigs injected with a similar quantity of the same milk heated at 60° C. for thirty minutes one became infected.

Taken by themselves, these experiments would indicate that the chances of infection are diminished with almost mathematical regularity as the time of exposure to a comparatively high temperature is increased, but as will afterwards be found this cannot be relied upon as holding good in any large number of cases, although where milk, whether raw or heated, is used, much more uniform results are obtained than when milk which had been purposely rendered infective by the addition of tubercular material is resorted to, and it must be assumed that the regular distribution of the infective material throughout the milk, the comparative isolation of individual bacilli, and their freedom from enclosing tissue or material contained in the milk, play an important part in determining this comparative uniformity in the results obtained.

In a similar series of experiments carried on with milk taken from another cow, although the control experiments, both feeding and inoculation, were all of them positive, heating the milk for five minutes and upwards at the above temperature appeared to have rendered it perfectly innocuous when introduced by the alimentary tract, whilst twenty-five minutes and upwards was quite sufficient to deprive it of its power of setting up tuberculosis, even when injected intraperitoneally. The animals in all these cases remained perfectly well, and on *post-mortem* examination showed no trace of tubercle in any part or organ of the body.

With milk from the same cow, a more complete series of experiments was made, the milk being maintained at 65° C. (149° F.) for periods varying from two-and-a-half minutes to eighteen hours. The result showed that an exposure to a temperature of 65° C. for two-and-a-half minutes was quite sufficient in this case to render tubercular milk innocuous. The results with the heated milk, both feeding and inoculation, were in all cases negative.

The results obtained in the series of experiments in which the milk was heated up to 70° C. for various times were somewhat irregular, although they indicate very clearly that tubercular milk may be very virulent and cannot always be readily sterilised; the limit of sterilisation, however, varies very greatly in the milk taken from different cows of which the udders are affected with tuberculosis. For example, in the milk taken from one cow the more delicate test of injection proved that the raw milk undoubtedly contained tubercular virus, as all three animals injected ultimately became tubercular. That the infective material in this milk, however, was not large in quantity, owing to the addition of a quantity of sound milk, or, because it had already been in some way attenuated, was evident from the fact that the course of the disease was much more prolonged, and certainly much more irregular, than in some of the other sets. One of the guinea-pigs died in thirty-eight days, a second in fifty-seven days, and the third not having died at the end of ninety-eight days was killed, when it was found to be tubercular.

So far had this attenuation been carried, or so few were the bacilli in the milk, that the feeding experiments with raw milk gave absolutely negative results, and it was not a matter for astonishment that this milk, heated even for fifteen minutes, was perfectly innocuous both as regards feeding and injection experiments. It is evident that the number of tubercle bacilli in the milk derived from any tubercular udder may vary from day to day, according to the amount and kind of the breaking down of the tubercular tissue in the udder, and according to the communication of the breaking-down areas with the milk ducts, the number of bacilli carried by leucocytes into the immediate neighbourhood of the ducts or into the ducts themselves, always being comparatively small.

Another set of experiments give entirely different results. These were carried on with the milk from another cow, during the time that a large number of tubercle bacilli could be demonstrated in the sediment and solid particles.

The control experiments with the raw milk give remarkably regular results, as out of nine animals fed (three guinea-pigs, three pigs, two cats, and one kitten), all with the exception of one guinea-pig developed tuberculosis; one of the guinea-pigs dying of tuberculosis in the comparatively short time of eighty-one days, showing that not only must the quantity of infective material present in the milk be large, but that it must also be extremely virulent.

The pigs were in every instance affected from the pharynx and tonsils, whilst, on the other hand, there was comparatively little evidence of infection from the lower reaches of the intestine; the mesenteric glands were undoubtedly somewhat enlarged, and there must have been infection from this point, but in not one of the pigs, even those fed with this raw material, could any ulcerative process of the intestine be demonstrated.

One out of each set of three guinea-pigs succumbed to tuberculosis when fed with this milk subjected to the action of a temperature of 70° C. for ten and fifteen minutes respectively, whilst in the case of the three experiments carried on with the same material heated for five minutes, one died too early to show tuberculosis; the others remained absolutely free, and as these animals were not killed until ninety-three days after they were fed, tuberculosis can scarcely be regarded as still latent after that period; the irregularity in these results must therefore be accounted for in some other way.

All the pigs fed, one each with the same series of milk, heated for five, ten, and fifteen minutes respectively at 70° C. developed tuberculosis. Here, apparently, the infection had been set up primarily from the pharynx, and only secondarily, or in a minor degree, from the intestine.

Of six animals injected with the raw milk, all died from tuberculosis, one in twenty-eight days, one in twenty-nine days, one in thirty, one in thirty-two, and one in thirty-three days—all within five days—the sixth, however, living for fifty-three days.

The inoculations with this milk heated to 70° C. for five minutes gave positive results in one guinea-pig out of three, showing that in this instance—although no positive results had been obtained in the case of guinea-pigs fed with milk heated at this temperature for five minutes—the milk still remained sufficiently infective to render one at least of the guinea-pigs tubercular by injection; on the other hand no positive result was obtained by injection with the same milk heated for ten and fifteen minutes, although in the raw state it had proved capable of inducing tuberculosis when ingested either by pigs or guinea-pigs.

But the same material heated for eleven and twelve minutes, and injected in quantities of ¾ cc., induced tuberculosis in the guinea-pigs on which it was tested.

It is evident from the experiments that raw milk from tubercular udders is in all cases possessed of the power of setting up tubercular infection, even when mixed with considerable quantities of sound milk, whilst in some cases it possesses this power in a most remarkable degree. Evidence is also afforded that as the time during which any fixed temperature is brought into play for the purpose of sterilising tubercular milk is extended, proportionably greater, on the whole, is the diminution in the virulence of the milk treated.

In the experiments dealing with tubercular milk, there is ample evidence to show that the virulence of different milks varies in a most marked manner, a variation that could be more or less distinctly measured, first of all by injection and feeding experiments on guinea-pigs, secondly by the length of exposure to certain experiments required to render it harmless. Thus, in one series of control experiments the milk, though infectious when injected into guinea-pigs, produced no results when ingested by these animals. In another case the raw milk proved fatal (setting up tuberculosis) to the guinea-pigs, both by feeding and injection, but a comparatively short exposure of this milk to a temperature of 70° C. rendered it perfectly innocuous also to guinea-pigs either by feeding or injection, whilst the milk from a third cow was of such a virulent character that it remained infective to guinea-pigs after being exposed for fifteen minutes to a temperature of 70° C. There can be little doubt that this variation is in great part dependent upon the dilution of the tubercular milk (and to the action of heat upon it), and, as has already been indicated by Böllinger and others in most elaborate series of experiments, the admixture of fresh milk even with the most virulent tubercular material drawn from the udder of a cow in an advanced stage of tuberculosis may be so diluted that it is no longer capable of setting up tuberculosis either by ingestion or by injection, the two theories given in explanation of this being (1) that the material is so diluted that the animal never receives a sufficiently large number of bacilli to constitute an infective dose; or (2) that the milk serum in a fresh condition exerts an active germicidal influence on the tubercle bacilli, and thus renders them innocuous after a certain dilution of the milk is attained, a certain amount of serum being required to exert the full germicidal action on a definite number of tubercle bacilli. Until these experiments have been repeated, with pigs as the animals experimented on, it will be impossible to obtain much more light on this question than has already been published, but the fact must be accepted that a certain dilution of tubercular milk renders it incapable of setting up tuberculosis in small rodents such as rabbits and guinea-pigs.

In many of the experiments that have been previously carried on to determine the infectivity of milk, the milk itself has only in certain cases been used as the infective agent. In Bang's admirable series of experiments, which were carried out rather to determine the presence of infective material in milk, than to determine the infective power of the milk, many of the experiments were carried on with a sediment obtained from milk that had been allowed to stand, or that had been centrifugalised. In Dr Woodhead's experiments, however, this sedimentation was not resorted to, and in many cases an additional quantity of healthy milk was added in order to bring the milk used into a condition more nearly resembling that in which it would be supplied in the milk market. It appears to be partly for this reason, but also partly from the varying number of bacilli met with in samples of milk taken from different cows with tubercular udders, that such variable results were obtained in his experiments, but when all these factors are taken into consideration, and when every allowance has been made both for the effects of dilution and for the action of the milk serum on the tubercle bacilli, the fact cannot be ignored that even the least virulent material with which he worked was sufficiently active to render it a source of very great danger to the community, if not subjected to some process of sterilisation by heat, for although the least virulent milk could be easily sterilised by a short exposure to a very moderate temperature, it was, before such exposure to heat, sufficiently virulent when injected into guinea-pigs to set up tuberculosis, and from what has been observed as to the relative infectivity between injection of a tubercular material into the guinea-pig, and ingestion of the same material by the pig, it may be argued that this least virulent material was still sufficiently active to set up tuberculosis in pigs, even when taken into the alimentary canal. This is a fact which should not be lost sight of, especially when the resemblances between the peri-pharyngeal tubercle of the pig and the scrofulous glands of the neck of the weakly child are taken into consideration. When, however, the milk has a still greater virulence, a virulence which can only be got rid of by exposing the milk to a high temperature for a comparatively long period, the gravity of the case is accentuated, and so long as such material can by any possibility find its way into a milk supply, so long must there be a very appreciable danger of the production of tuberculosis in the human subject, especially in weakly children, arising from this source, and so long should instructions be given for the sterilisation of milk before it is used.

As many people object very strongly to the taste of milk that has been subjected to boiling, some method of heating or scalding should be adopted which reduces to a minimum this peculiar taste. This heating, however, can only be a temporary expedient, and one which must be resorted to by consumers in their own interest, and to protect themselves and their children against what is a very definite and real danger, but the danger should be met at a point not only before the milk comes into the hands of the customers, but before it is possible to get into the hands of the dairy-keepers, and this can only be done by having recourse to a well-organised system of inspection of all cattle on every dairy farm.

Heating of Milk.—Exposure of even virulent tubercular milk to a temperature of 85° C. for five minutes is sufficient to render it innocuous even when injected into the peritoneal cavity of a guinea-pig, although the same material when rapidly brought up to a temperature of 90° C. still remains capable of infecting guinea-pigs by injection. It is evident, therefore, that in order to ensure complete sterilisation of milk it should be maintained at a comparatively high temperature for a lengthened period, but this temperature should never be so high that the peculiar mawkish taste imparted to milk by boiling is acquired. In order to steer clear of this peculiar taste many householders place the milk in an earthenware jar or tin pannikin, place this in a pan

containing a quantity of water, and, bringing this up to the boiling point, think that such treatment is sufficient to sterilise it. In order to test how far this is an efficient method of treatment experiments were carried out, and these showed that milk to be properly scalded and sterilised should be kept in the scalding pan for at least half-an-hour. This would only just be sufficient to render it absolutely certain that the milk was sterilised.

The indications for sterilising milk by this method are :—

(1.) That the quantity of milk should never be more than the quantity of *cold* water by which it is surrounded; it is an advantage, in fact to have a somewhat larger bulk of water than of milk to allow for evaporation ;

(2.) The milk should not be covered in, and should be stirred from time to time, but the water may, with advantage, be covered in order to prevent evaporation; this of course is arranged for in the special milk sterilising pans;

(3.) The water should be boiled over a good brisk flame in order that the best results may be obtained, and the heating process should be continued until the temperature throughout the milk has risen to from 88° C. to 92° C. ; in most cases this takes place at the end of about twenty-five minutes, but in order to be perfectly safe it may be recommended that every quart of milk treated in this fashion should be heated for half-an-hour, that is for about twenty minutes after the water in the outer pan has begun to boil.

One great advantage of this method of sterilisation is that after the pan is placed on the fire or gas-stove it needs little attention beyond an occasional stirring until the end of the half-hour.

Milk treated in this manner may be looked upon as "sterilised," and as perfectly innocuous even though it should contain the bodies of a considerable number of tubercle bacilli.

The mere scalding of milk by bringing the outside water up to boiling point is quite inadequate to sterilise tubercular milk. In one case the temperature of the milk had only been brought up to 41° C. when the water boiled, and even in the other case, although the water had been boiling some time when the temperature in the milk was taken, at the end of ten minutes it had only reached 68° C., both of these temperatures being quite inadequate to render the tubercular material, unless present in the most minute quantity, innocuous.

VETERINARY AND MEDICAL INSPECTION OF ALL DAIRY FARMS AND DAIRIES.

It has been suggested that it would be impossible to get a sufficiently large number of veterinary surgeons versed in modern pathological methods and sufficiently well trained in morbid anatomy and comparative pathology to carry out any thorough and systematic plan of inspection. After a careful study of a system of voluntary submission to inspection as carried out in Denmark and Sweden in some of the dairy farms there, and after a careful consideration of the course of training, and some of the experience of the examinations in pathology to which those students who are entering the veterinary profession have to submit, Dr Woodhead is thoroughly convinced that this objection is one that would readily be met, especially if some arrangement could be arrived at by which the veterinary inspectors of a district could co-operate with the medical officer of health.

In Denmark, where tuberculosis amongst dairy cattle is of very frequent and widespread occurrence, a fortnightly inspection is made on every farm, in certain voluntary associations, by the veterinary surgeon, and every fortnight all animals suffering from any form of disease pass through his hands, whilst

every animal on the farm is inspected once a month. If such regular inspection can be of advantage in a country where so large a proportion of the wealth is derived from farming and dairying, and where in consequence the interests of producers must bulk so much more largely in proportion to those of the national consumer than in this country, and if these producers are not only willing but anxious to submit to inspection, how much less should inspection be shirked in this country.

Should the intervals of inspection be greater than a fortnight the value of inspection would be enormously diminished as far as protection of the consumers of milk against what must now be recognised as a very grave danger goes. Beyond this, however, it has been pointed out that the tubercular lesion of the udder may occur at any period of the disease, not only when it has been localised to the glands or to special cavities, but also when the disease has become much more generalised. In view of these facts the following should be laid down as definite instructions to veterinary inspectors:—

(*a.*) That all tubercular animals, whether affected with udder disease or not, should be eliminated from a dairy supply, removed from the farm and slaughtered at as early a date as possible, it being pointed out to the farmer that every day that the animal lives diminishes the value of the carcase, the milk being no longer of the slightest value.

(*b.*) That every animal suffering from *any* disease of the udder should be carefully isolated and milked after all the other cows have been milked, or by a separate milker; this milk should from time to time be carefully examined both chemically and microscopically. If used at all it should be carefully boiled, and only after such treatment should it be given to pigs or other animals, though the risk of doing this should be carefully pointed out to the farmer. Only after a certificate has been given by the veterinary surgeon in consultation with the medical officer of health, should the milk from any cow suspected of udder disease be allowed to pass into circulation.

(*c.*) The registration of all dairy premises and of every animal bought for or sold from these premises should be carefully made out and kept by the veterinary inspector, and notes on the condition of every suspected animal should be entered up at each visit. Some system of notification combined with one of compensation would add enormously to the value of this system of inspection, and would greatly facilitate the working of the system.

NATIONAL VETERINARY ASSOCIATION.

The Fourteenth Annual General Meeting of the National Veterinary Association will be held at the invitation of the Eastern Counties Veterinary Society in the Assembly Rooms, Great Yarmouth, on Wednesday and Thursday 8th and 9th July, 1896, under the Presidency of Mr William Bower, East Rudham, Norfolk.

Professor M'Fadyean has consented to contribute a paper on "Swine-fever, its nature and suppression." The discussion will be opened by Mr Clement Stephenson and by Professor Edgar.

Professor W. Almond, has promised to introduce for discussion "A practical method of gradually, effectively, and cheaply reducing bovine tuberculosis to manageable proportions and ultimately stamping it out."

The great and urgent importance of these subjects should ensure a large attendance of the profession.

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ON NIEBEL'S METHOD OF DETECTING HORSE-FLESH.

By A. M. TROTTER, M.R.C.V.S., Edinburgh.

(*From the Research Laboratory of the Royal College of Physicians of Edinburgh.*)

THE object of this paper is to direct attention to an effectual means of preventing the fraudulent sale of horseflesh in the various food preparations. Possibly no other food adulterant is held in so great an abhorrence by the British public as horseflesh. As is well known, the flesh of the horse is recognised as a staple article of food on the Continent, but there it is only permitted to be retailed for human consumption after it has been duly passed by the Veterinary Inspector as being in a fit and wholesome condition. It may be interesting in this connection to give a short description of the careful surveillance adopted by the continental authorities in regulating this trade, and no better example of this could be desired than that prevailing in the Berlin Centrale • Ross Schlachterei situated in Grefswalder Strasse, where some 9000 horses are annually slaughtered. Here much the same procedure as that adopted in the case of oxen at the Berlin Central Viehhof is pursued. The animals before being killed are kept under strict supervision for at least twenty-four hours, and if during that time any departure from the normal health has become manifest the animal is at once removed to the knacker's yard and there disposed of. But if, on the contrary, nothing can be detected the animal is here slaughtered, and the viscera are carefully scrutinised. If the examination has been satisfactory the carcase receives the official stamp in eight places, that is, each quarter bears in prominent positions two impressions. As no one is permitted to have in his possession an unstamped carcase it may safely be said

that such a system is well-nigh perfect. Should a carcase showing no evidence of having received the official stamp be found in anyone's possession it is at once seized and destroyed by the police, and the possessor is severely punished.

To question the wholesomeness of horseflesh when prepared under such exacting conditions would be entirely out of place, and the desirability of such flesh as an article of food must depend entirely upon the gustatory inclinations of the individual. Unfortunately for the epicure who hungers after this delicacy in this country, it is almost impossible to procure it in a wholesome condition, as he is compelled by force of circumstances to rely solely on the knacker's yard for his supplies. To these establishments came the dead and the dying, the maimed and the incurable, the aged and the worn-out members of the equine species, and, as there is no supervision over those places, the horseflesh of this country must be looked upon as more than suspicious.

It is well for us to remember that the majority of those cases of meat poisoning which have been placed on record were due to the use of the flesh of animals that had either died a natural death or that had been killed when suffering from some illness. Within recent years there have been isolated from the tissues of such animals certain bodies which possessed in most instances extremely toxic properties. It is to the presence of these ptomaines and leucomaines that the flesh obtained from diseased animals owes its poisonous qualities, and it is within the range of probability that it is to their unsuspected presence that many cases of intestinal disorder in the human subject are due. Not only may they cause diarrhœa and similar disorders, but they are also capable of setting up much graver conditions, and even death itself may result from their ingestion. Thus it is that this trade in diseased horseflesh must not be considered as merely a dishonest practice, but as one of the most heinous crimes that can be committed against mankind.

Actuated by a desire to protect the public from this danger, an Act entitled the "Sale of Horseflesh Act" was passed in 1889. This Act provides that: "On and after the 29th September 1889, it will be unlawful for anyone to sell, offer, expose, or keep for sale any horseflesh for human food elsewhere than in a shop, stall, or place over or upon which there shall be at all times painted, posted, or placed, in legible characters of not less than 4 inches in length, and in a conspicuous position, and so as to be visible throughout the whole time whether by night or day, during which such horseflesh is being offered for sale, words indicating that horseflesh is sold there. And no one is to supply horseflesh for human food to any purchaser who has asked to be supplied with some meat other than horseflesh, or with some compound article of food which is not ordinarily made of horseflesh. For the purposes of this Act, the term 'horseflesh' is to include the flesh of asses and mules, and shall mean horseflesh, cooked or uncooked, alone or accompanied by, or mixed with any other substance."

It is deeply to be regretted that this Act has been till now of little service in suppressing this illicit traffic in diseased horseflesh, as the detection of the fraud is rendered extremely difficult by the removal of the bones, by the mincing of the flesh, and by the admixture of ox

suet. Such being the case it is imperative that if the public are to be protected a thoroughly reliable means of detecting the presence or otherwise of horseflesh in the various food preparations must be employed. Unfortunately, however, this test of Niebel's requires some time for its performance, but there is no reason why the "Sale of Food and Drugs Act 1875" should not be here utilised. An inspector could then purchase from a vendor a small quantity of the suspected article, treat it in the same manner as he would any other article of food, and then, by submitting it to analysis, determine its nature. Were this test to be universally adopted in this country, and stringently enforced, the trade in horseflesh, which at present is permitted to run rampant in urban and rural districts alike, would soon be a thing of the past.

The fundamental principle of this method of detection lies in the presence or absence of glycogen. Formerly this substance was regarded by scientists as being only present in living tissue, and it was thought that after death it was rapidly converted into sugar. That this action does occur in the muscular tissues of most animals has been demonstrated by numerous observers. The exception in the case of horseflesh, however, is of more than usual importance, for whilst being of theoretical interest it is capable of a practical issue of immense value as a diagnostic agent. From his investigation Niebel arrived at the following conclusion:—"Im Pferdefleisch im Verhaltniss zu den anderen Fleischarten grosse mengen Glycogen vorkommen, und zwar in der Menge dass ohne Rücksicht auf das Alter des Fleisches die Kleinsten im Pferdefleisch gefunden Werte die höchsten bei den anderen Fleischarten erhaltenen Werte übertreffen" (*Handbuch der Fleischbeschau, von Ostertag* 1892, p. 117).

As Niebel in his research had adopted Kulz's method it was deemed advisable to continue this mode of extraction. Vintschgau and Dieth ("Pfluger's Arch," vol. xiii., pp. 187, 253) have shown that the addition of the potash may cause a disappearance of a small amount of glycogen, but as the one method was employed throughout the entire series the results obtained may be considered as fairly accurate. A piece of muscle, of from 10 to 20 grammes, after being finely minced and freed from all fibrous and adipose tissue, was thrown into actively boiling water and boiled for one hour. The fluid was then passed through a linen filter and the muscle was well squeezed. The latter was transferred to a beaker containing a 5 or 10 per cent. solution of caustic potash and boiled for four hours, again filtered, and the residue, if any, subjected to similar treatment till all the glycogen was removed. A very large proportion of water was employed to facilitate its extraction. This voluminous filtrate was then evaporated to about 200 cub. centimetres, neutralised with hydrochloric acid, and the proceeds precipitated by adding alternately in small quantities hydrochloric acid and mercuric potassic iodide until no further precipitation occurred, after which it was filtered. The precipitate was also well washed with water containing mercuric potassic iodide and hydrochloric acid. To the filtrate thus obtained four times its volume of methylated spirit was added, and after standing for twenty-four hours the precipitate, if any, was brought on to a dried and weighed filter paper, washed first with 75 per cent. alcohol, then with methylated spirit, then with

absolute alcohol, and finally with ether. It was then dried at 110° C. till found constant, and afterwards weighed. The ash was not determined, but double estimations were in most instances carried out in order to check the results.

EXPERIMENT I.—*5th February* 1895.

Animal	Bullock.
Age of animal	Two years.
Region of carcase . . .	Cervical.
Quality of the flesh . . .	Good.
Age of the flesh . . .	Three days.
Solids	26·818
	73·182
	100·000
Glycogen—*A*. Five grammes .	None.
B. Twenty grammes .	None.

EXPERIMENT II.—*7th February* 1895.

Animal	Cow—Tuberculous.
Age of animal	Aged.
Region of carcase . . .	Thigh.
Quality of flesh . . .	Good.
Age of flesh	Twenty-five hours.
Solids	27·996
	72·004
	100·000
Glycogen—Twenty grammes .	None.
Twenty grammes .	None—*8th February* 1895.

EXPERIMENT III.—*11th March* 1896.

Animal	Bullock—choked on turnip.
Age of animal	Two years.
Region of carcase . . .	Biceps femoris.
Quality of flesh . . .	Good.
Age of flesh	Five days.
Reaction of flesh . . .	Alkaline.
Solids	24·848
	75·152
	100·000
Glycogen—*A*. Twenty grammes .	None.
B. Twenty grammes .	None.

EXPERIMENT IV.—*14th March* 1895.

Animal	Cow.
Age of animal	Aged.
Region of carcase . . .	Vastus externus.
Quality of flesh . . .	Indifferent.
Age of flesh	Twenty-six hours.
Reaction	Neutral.
Solids	24·907
	75·093
	100·000
Glycogen—*A*. Twenty grammes .	None.
B. Ten grammes .	None.

EXPERIMENT V.—*17th March* 1895.

Animal	Cow.
Age of animal	Aged.
Region of carcase	Haunch.
Quality of flesh	Indifferent.
Age of flesh	Twelve hours.
Reaction	Neutral.
Solids	23·723
	76·277
	100·000

Glycogen—*A*. Twenty grammes. None.
B. Ten grammes . None.

EXPERIMENT VI.—*22nd March* 1895.

Animal	Pig.
Age of animal	About nine months.
Region of carcase	Biceps femoris.
Quality of flesh	Indifferent.
Age of flesh	Sixteen hours.
Reaction	Neutral.
Solids	23·690
	76·310
	100·000

Glycogen—Twenty grammes = ·050 = 0·250.
Ten grammes = ·026 = 0·260.

EXPERIMENT VII.—*26th March* 1895

Animal	Pig.
Age of animal	Unknown.
Region of carcase	Haunch.
Quality of flesh	Good.
Age of flesh	Four days.
Reaction	Neutral.
Solids	24·150
	75·850
	100·000

Glycogen—*A*. Twenty grammes. None.
B. Twenty grammes. None.

EXPERIMENT VIII.—*25th March* 1895.

Animal	Ewe.
Age of animal	Five years.
Region of carcase	Haunch.
Quality of flesh	Good.
Age of flesh	Three days.
Reaction	Neutral.
Solids	24·450
	75·550
	100·000

Glycogen—*A*. Ten grammes . None.
B. Ten grammes . None.

EXPERIMENT IX.—*20th March* 1895.

Animal	Horse.
Age of animal	Aged.
Region of carcase . . .	Longissimus dorsi.
Quality of flesh	Good.
Age of flesh	Two days.
Reaction	Neutral.
Solids	23·684
	76·316
	100·000

Glycogen—*A*. Twenty grammes . . 0·375 = 1·875
„ *B*. Twenty grammes . . 0·370 = 1·850

Age of flesh . . . . Four days. *22nd March* 1895.
Reaction . . . . Neutral.

Glycogen—*C*. Twenty grammes . . 0·290 = 1·450

Age of flesh . . . . Eight days. *26th March* 1895.
Reaction . . . . Alkaline.

Glycogen—*D*. Twenty grammes . . 0·275 = 1·375

EXPERIMENT X.—*30th March* 1895.

Animal	Horse.
Age of animal	Unknown.
Region of carcase . . .	Longissimus dorsi.
Quality of flesh	Good.
Age of flesh	Two days.
Reaction	Acid.
Solids	27·184
	72·816
	100·000

Glycogen—*A*. Twenty grammes . . 0·290 = 1·450
„ *B*. Ten grammes . . 0·140 = 1·400

Age of flesh . . . . Ten days. *8th April* 1895.
Reaction . . . . Alkaline.

Glycogen—*C*. Twenty grammes . . 0·185 = 0·925
„ *D*. Ten grammes . . 0·090 = 0·900

No.	*Animal.*	*Age of Flesh.*	*Quality of Flesh.*	*Result.*
1	Ox	12 hours	Indifferent	None
2	„	25 „	Good	„
3	„	26 „	Indifferent	„
4	„	2 days	Good	„
5	„	3 „	„	„
6	„	5 „	„	„
7	Pig	16 hours	Indifferent	0·260
8	„	4 days	Good	None
9	Sheep	3 „	„	„
10	Horse	2 „	„	1·850
11	„	2 „	„	1·400
12	„	4 „	„	1·450
13	„	8 „	„	1·375
14	„	10 „	„	0·900

The results obtained in this series of experiments fully corroborate the conclusion arrived at by Niebel, and as they amply demonstrate the value of this method of detection it is not too much to anticipate that as it becomes better known in the country it will be universally adopted as the only sure means of safeguarding the public against a food (?) possessing qualities which are in a high degree capable of spreading illness, disease, and death.

NOTES ON THE USE OF HYDROCYANIC ACID AS AN ANTIDOTE TO CHLOROFORM, AND VICE VERSA.

By FREDK. HOBDAY, Professor of Therapeutics, Royal Veterinary College, London.

HAVING observed that the respiratory centre was usually paralysed first when death occurred during chloroform anæsthesia, and thinking that, on account of its rapidity of action and powerful temporary excitant effect upon the respiratory centre, hydrocyanic acid ought to be of service as an antidote in cases where the breathing was becoming shallow and weak, I ventured to test its value whenever opportunities occurred. The results, which appear below, exceeded my expectations, and, I think, certainly show that this drug deserves a prominent place amongst the agents used as antidotes to chloroform, and also that chloroform itself is of value as a palliative to an overdose of hydrocyanic acid.

The following is a list of cases in which success attended the administration :—

CASE 1.—Fox terrier, dog, 26 lbs. weight, anæsthetised by chloroform applied on a towel.

After being under for five-and-a-half minutes the respirations suddenly ceased. Fifteen seconds later a hypodermic injection of 4 minims of hydrocyanic acid in 16 minims of water was given and artificial respiration applied. Two-and-a-half minutes after this the respirations recommenced, and one minute after this were quite strong and regular. Eight minutes after receiving the injection the dog could sit up, and it finally made a good recovery.

CASE 2.—Calf, about three or four months old, anæsthetised by chloroform.

After being under for five minutes the respiration suddenly ceased. As quickly as possible a hypodermic injection of 2 minims of hydrocyanic was administered and artificial respiration applied. Respirations recommenced thirty seconds after the injection of the acid, becoming quite strong and regular in one minute. The animal was sufficiently recovered to be able to walk seven minutes later.

CASE 3.—Blenheim spaniel bitch, about 14 lbs. weight, four or five years old, was placed under the influence of chloroform, in order to undergo the operation of excision of the eyeball.

After the operation was completed she appeared to be recovering well, but suddenly suffered from syncope owing to the shock, and dropped her head on the operating table. A subcutaneous injection of 2 minims of Scheele's hydrocyanic acid caused a visible

improvement in one minute; respirations, which had previously been very slow, became accelerated, and the animal made a good recovery.

CASE. 4.—Bull bitch, about ten or twelve months old.

After a lapse of twenty-five minutes under chloroform anæsthesia respirations became shallow, dangerous, and almost imperceptible. Upon noticing this 3 minims of hydrocyanic acid were placed upon the tongue; in about forty seconds the respirations became quite strong and regular, and recovery finally ensued.

CASE 5.—A retriever bitch after having been under chloroform for eight minutes suddenly commenced to show signs of danger, the respirations becoming very shallow and feeble.

The chloroform towel was at once removed and 10 minims of hydrocyanic acid administered hypodermically. In three minutes the respirations became strong and deep, then somewhat laboured owing to the large dose of acid which had been administered. The chloroform vapour was cautiously reapplied, the effect being to render the respirations tranquil and regular almost immediately. Whenever the chloroform was removed the respirations again became laboured. The balance was maintained between the two drugs for an hour and a half, when the vapour of ammonia was applied to the nostrils at intervals. Two hours after receiving the acid the animal could sit up, and it eventually made a good recovery.

Remark.—The length of time taken for the animal to recover was entirely due to the large dose of acid administered.

CASE 6.—A cat, whilst anæsthetised by chloroform, suddenly commenced to show signs of danger.

The respirations rapidly became shallow and suddenly ceased. As quickly as possible 1 minim of hydrocyanic acid was placed on the tongue, artificial respiration applied, and vapour of ammonia cautiously held to the nostrils. Respirations recommenced and the animal recovered.

CASE 7.—Fox terrier, dog, poor condition.

5.1 P.M. Applied ʒij of chloroform on one fold of towel loosely held to the nostrils so as to admit plenty of air.

5.2. Complete anæsthesia. Respirations very shallow and then suddenly ceased. The chloroform was at once removed.

5.3. Injected subcutaneously acid hydrocyanic (Scheele) mv. and applied artificial respiration continuously. There was no response for three minutes, when respirations recommenced. The pulse at the femoral had become very indistinct, but now became distinct again and much accelerated.

5.8. Vomiting occurred (apparently had recently been fed).

5.10. More attempts at vomition. Clonic spasms of muscles (due to the acid hydrocyanic). Applied chloroform to nostrils, and this instantly caused relief of the spasms. For ten minutes longer the respiration was carefully maintained as placid as possible by administering chloroform whenever the toxic symptoms of the acid became apparent, the attempt being to maintain a balance between the two.

5.20. Could hold head up and took notice when spoken to.

5.28. Able to walk, though still showing slight acceleration of respiration.

Recovered well.

CASE 8.—Fox terrier, dog, five months old, anæsthetised with chloroform by aid of a sponge and towel.

For seven minutes all went well, but at this stage the respirations became very shallow and dangerous. A hypodermic injection of 2 minims of hydrocyanic acid mixed with 8 minims of water was given, and artificial respiration performed. In one minute the respirations became stronger and regular, the animal making a good recovery.

CASE 9.—Fox terrier, bitch, 18 lbs. weight, after being safely anæsthetised for forty minutes suddenly commenced to show signs of danger, and the respirations ceased. Thirty seconds later 2 minims of hydrocyanic acid were applied to the back of the tongue by means of a drop tube, and artificial respiration applied. Half a minute after the application of the acid the respirations recommenced and speedily became strong and regular, the animal being able to sit up eight minutes afterwards, and making a good recovery.

CASE 10.—Mongrel deerhound, 32 lbs. weight; was safely maintained in a state of anæsthesia for seven minutes, when the respirations became very feeble, shallow, and almost imperceptible. Five minims of hydrocyanic acid in 20 minims of water were given hypodermically and artificial respiration practised. Two minutes later the breathing was strong and regular, and the animal was soon out of danger.

CASE 11.—Mongrel pug-dog, eight months old, 13 lbs. weight; was safely anæsthetised for thirty minutes by means of chloroform given through an inhaler, the method of administration at this stage being changed to a sponge and towel.

Four minutes later the respirations became slow, shallow, and spasmodic. Immediately upon noticing this the chloroform was removed, and, one minute later, a hypodermic injection of 3 minims of hydrocyanic acid in 12 minims of water administered, artificial respiration being applied. Two minutes afterwards the respirations increased in force and became more regular, the animal making a good recovery.

CASE 12.—Fox terrier, dog, five or six months; after being safely anæsthetised for six minutes began to show signs of danger, the respirations becoming very shallow and spasmodic.

Three minims of hydrocyanic acid were given hypodermically; half a minute later the animal gave a deep inspiration. Artificial respiration was then resorted to, and the breathing gradually improved during the next five minutes. At this stage the action of the large dose of acid became manifest, showing its effect particularly upon the limbs and respiratory muscles. Attempts at vomition occurred, but the stomach was apparently empty. These symptoms gradually passed off, and the animal made a good recovery.

CASE 13.—Irish terrier, bitch, two-and-a-half years old. Towards the end of a very severe operation on the abdomen, and probably largely due to the position in which she was secured for so long a time and to saliva which had collected near the mouth and nostrils, respirations became shallow. A hypodermic injection of 3 minims of acid hydrocyanic (Scheele) was at once given; one minute later the respirations improved, two minutes after that they were perceptibly quicker than normal, and six minutes after the injection had been given she could stand up, making a good recovery.

CASE 14.—Collie bitch, eighteen months old. Safe anæsthesia was maintained for thirty minutes; after removal of the chloroform 5

minims of hydrocyanic acid were injected subcutaneously with the idea of hastening recovery. Respirations became accelerated and stronger, the animal being able to walk away thirteen minutes later.

CASE 15.—Manchester terrier, good condition; whilst anæsthetised showed signs of danger, the respirations becoming shallow and feeble.

Two minims of hydrocyanic acid were given hypodermically and artificial respiration resorted to. Almost immediately the breathing became stronger, and the animal made a good recovery.

CASE 16.—Cat, male, 7 lbs. weight, about eight months old, anæsthetised with chloroform by aid of a drop bottle and cloth. All went well for thirty-two minutes, but at this stage the respirations suddenly ceased. Thirty seconds later 3 minims of hydrocyanic acid were applied to the tongue and artificial respiration applied.

4.56 P.M. One minute after the application of the acid the respirations recommenced and were strong and regular.

4.58. The vapour of ammonia was cautiously applied to the nostrils.

5.5. The animal now exhibited effects of the large dose of acid which had been given, respirations being laboured and limbs stretched out. Chloroform was cautiously reapplied, the effect being to cause the respirations to become tranquil, and the other symptoms caused by the acid to disappear. The balance was maintained between the two for some little time, and the animal made a good recovery.

CASE 17.—Fox terrier, bitch, four or five years old, anæsthetised by chloroform administered from a drop bottle. During the administration the respirations became almost imperceptible, very faint, shallow and irregular, and then ceased.

Thirty seconds later 3 minims of hydrocyanic acid were placed on the tongue and artificial respiration applied. Two minutes after this respirations were regular and strong, and the animal made a good recovery.

CASE 18.—Retriever, dog, seventeen years old. Whilst being anæsthetised with chloroform the respirations ceased, but recommenced very feebly as soon as the chloroform was removed. At this stage 5 minims of hydrocyanic acid were placed on the tongue and artificial respiration applied. In about twenty seconds the respirations became regular and strong, then spasmodic and laboured; the chloroform vapour was cautiously reapplied to the nostrils, the effect being to make the breathing quiet and regular again. The balance was maintained between the two for some little time until the patient was out of danger.

CASE 19.—A mongrel Irish terrier, dog, six months old, 17 lbs. weight, was safely anæsthetised by Junker's inhaler for some considerable time, but respirations became irregular, then feeble, and almost imperceptible. The chloroform was removed, and three minutes later, as the respirations did not improve, 4 minims of hydrocyanic acid were subcutaneously injected and artificial respiration applied. In three-quarters of a minute the respirations became strong and regular, then laboured owing to the large dose of acid given. Chloroform was cautiously applied, the effect being to instantly quieten the spasms and make the breathing regular. The balance was carefully maintained between the two drugs for thirteen minutes, when the animal appeared to be out of danger, and it made a good recovery.

CASE 20.—A fox terrier mongrel, bitch, about eighteen weeks old, 7 or 8 lbs weight, had been anæsthetised by chloroform applied on a towel. After about eight minutes the respirations became spasmodic, then ceased. About twenty seconds later 2 minims of hydrocyanic acid were placed on the back of the tongue and artificial respiration applied. Half a minute after this the respirations recommenced and continued for a few times, then ceased completely for two minutes, when they again commenced and rapidly became deep, strong, and regular. Four minutes later the animal was conscious to sounds and licking the lips continually. The effects of the acid were slightly manifested on the limbs, but recovery was rapid without any further trouble.

CASE 21.—Fox terrier, dog, age unknown, was anæsthetised by chloroform applied on cotton wool and towel. All went well for five minutes, when respirations suddenly became very shallow, feeble, and almost imperceptible. The chloroform was removed at once and artificial respiration applied, but, as the character of the breathing had not improved one minute later 3 minims of hydrocyanic acid were subcutaneously injected. Thirty seconds after the injection the respirations became perceptibly stronger, and ten minutes after this the animal was quite out of danger and could stand up.

CASE 22.—A fox terrier, dog, about twelve years old, was anæsthetised safely for eleven minutes, when the breathing became very irregular and stertorous; the chloroform was at once removed and the symptoms passed off; as the operation was not completed the towel was reapplied and anæsthesia again produced, but the breathing shortly afterwards became very shallow and almost imperceptible. Four minims of hydrocyanic acid were then given subcutaneously, the effect being to cause a decided improvement in the character of the respirations in one minute, this giving place two minutes after the injection to laboured breathing owing to the large dose of acid. Cautious reapplication of the chloroform immediately rendered the breathing tranquil and regular again. The balance was carefully maintained between the two for twelve minutes, when the patient could stand and was out of all danger.

CASE 23.—Fox terrier, bitch, poor condition, 17 lbs. weight. After being completely under the chloroform for two minutes respiration suddenly ceased (9.22).

9.23. Placed 2 minims of hydrocyanic acid on the tongue, and applied artificial respiration. Thirty seconds later the respirations recommenced.

9.24. Respirations regular and strong.

9.26. Reapplied the chloroform.

9.28. Complete anæsthesia; commenced the operation.

9.41. Respirations became irregular, then ceased, but recommenced slowly when the chloroform and towel were removed.

9.44. Respirations ceased altogether. As quickly as possible (about thirty seconds later) placed 3 minims of hydrocyanic acid on the tongue and commenced artificial respiration.

9.46. Respirations just recommenced.

9.48. Respirations strong and regular.

9.51. Quite conscious to sounds and licking the lips.

9.52. Vomiting.

9.54. Could raise head, and finally made a good recovery.

CASE 24.—Cat, aged thirteen years, 9 lbs. weight, anæsthetised with chloroform by the aid of a drop bottle and cloth. Two minutes after anæsthesia had been produced the respirations suddenly ceased.

Seventy seconds later 2 minims of hydrocyanic acid were applied to the tongue, the latter organ being pulled forward in and out of the mouth in a jerky manner, but no artificial respiration applied. Respirations recommenced and speedily became regular and strong.

Three minutes after the acid had been applied the respirations were laboured and spasmodic owing to the acid, but instantly became tranquil when chloroform was cautiously applied to the nostrils. The balance was carefully maintained between the two for six minutes longer, when the patient was quite out of danger.

CASE 25.—Manchester terrier, eighteen years old, poor condition, anæsthetised with chloroform. All went well for eight minutes, when respiration ceased (11.20 A.M.).

11.21. Placed 4 minims of hydrocyanic acid in 16 minims of water on the tongue, and applied artificial respiration.

11.22. Respirations recommenced.

11.24. Respirations deep and regular.

11.25. Respirations laboured; cautiously reapplied chloroform to the nostrils, the result being to render the breathing quiet and tranquil at once.

11.29. Respirations ceased.

11.30. Respirations recommenced and continued, soon becoming strong and full.

11.35. The patient was recovering well and quite out of danger.

CASE 26.—Mongrel retriever. Anæsthetised with chloroform by aid of a drop bottle and cloth. After having been completely under for one minute the respirations became very shallow and then ceased.

10.45. Thirty-five seconds later 5 minims of hydrocyanic acid were applied to the tongue and artificial respiration commenced.

10.46. No response. Applied 5 minims of the acid to the nostril.

10.50. Respirations recommenced and speedily became regular and strong.

10.51. The patient was semi-conscious to sounds.

10.54. Quite conscious. Breathing strong and regular. Recovery after this was rapid.

CASE 27.—Mongrel, bitch, about 5 or 6 lbs. weight, ten or twelve weeks old. Whilst being anæsthetised by chloroform administered on wadding the respirations ceased.

Thirty seconds later 2 minims of hydrocyanic acid were placed on the back of the tongue and artificial respiration applied.

Thirty-five seconds after this the respirations recommenced, and in one-and-a-half minutes became laboured and spasmodic owing to the acid. Chloroform was cautiously reapplied, the effect being to almost instantly quieten the breathing and make it regular. The balance was maintained between the two for fifteen minutes, when the patient was quite out of danger.

CASE 28.—Sheep, between two and three years old. Whilst being anæsthetised by chloroform, applied on cotton wool, the respirations ceased. As quickly as possible the chloroform was removed and (ten

seconds later) 6 minims of hydrocyanic acid placed on the tongue, artificial respiration being applied.

In one minute the respirations recommenced, then ceased, and commenced again. The effect of the acid became manifest, but was completely tranquillised by the cautious application of chloroform to the nostrils. The balance was maintained between the two until the animal was out of danger.

CASE 29.—Cat, 5¼ lbs., poor condition. Chloroform was being administered by the aid of a towel and some tow, when the respirations suddenly ceased (2.10).

2.11. Applied 2 minims of hydrocyanic acid to the tongue, and commenced artificial respiration.

2.12. No signs of respiratory efforts ; heart distinctly beating.

2.14. Respirations recommenced, first gasping, then irregular and laboured.

2.15. Head and limbs drawn together owing to the action of the acid ; cautiously reapplied chloroform, the effect of which was to immediately quieten the spasms.

The balance was maintained between the two till 2.40, when the animal was quite conscious and could sit up.

CASE 30.—Fox terrier, 22 lbs. weight, anæsthetised by chloroform administered on a sponge and towel.

11.14. Respirations became shallow and feeble.

11.16. Respirations ceased. Thirty seconds later injected 4 minims of hydrocyanic acid subcutaneously.

11.17. Commenced artificial respiration ; applied ammonia vapour to the nostrils.

11.19. Respirations recommenced.

11.20. Respirations quite strong and regular. This continued, and the patient made a rapid recovery.

CASE 31. For the notes of this case I am indebted to Mr A. C. Pierce, M.R.C.V.S., who administered the antidote.

A thoroughbred horse, a cryptorchid, was placed under chloroform in order to be operated upon. The respirations became shallow and ceased, the pulse still being perceptible. As soon as this was noticed artificial respiration was commenced, and half a minute later an injection of 20 minims of hydrocyanic acid (Scheele) was administered. Within a minute after the injection respiration recommenced, then rapidly became strong and regular. The animal made a good recovery.

The following is a list of the cases in which there was an unsuccessful result :—

CASE 32.—Mongrel Newfoundland dog, eight years old.

Anæsthesia was produced in two-and-a-half minutes by the application of chloroform on wadding and towel.

Half a minute later respirations became spasmodic, and in two minutes ceased completely, the pulse still beating perceptibly. Owing to delay in obtaining the acid, three minutes elapsed before it could be applied, but artificial respiration was commenced at once. After the lapse of three minutes 7 minims of hydrocyanic acid were injected into the thoracic cavity, artificial respiration being continued, and ammonia vapour applied to the nostrils. All efforts were unavailing.

Remark.—The time that elapsed before being able to obtain and use the acid assists in explaining, to some extent, its failure in this case in producing the desired result.

CASE 33.—Fox terrier, six months old. In order to produce anæsthesia 1 drachm of chloroform was applied on a towel; this had the desired effect in one-and-a-half minutes, but one minute later the respirations suddenly ceased, although the pulse could be distinctly felt.

Thirty seconds later 5 minims of hydrocyanic acid were injected subcutaneously over the left cardiac region, and artificial respiration resorted to.

Three minutes later the respirations recommenced, continuing spasmodically for one-and-a-half minutes, and then ceasing altogether.

All further efforts to restore the breathing failed, although the heart distinctly beat for four minutes longer.

Remark.—The dose of Scheele's acid given in this case hypodermically was undoubtedly too large for so young a dog. Another cause of the want of success was contained in the fact that the towel was folded four times, and so largely excluded air, thus giving the vapour of chloroform in much too concentrated a form, and really asphyxiating the animal.

CASE 34.—Pug dog, very old, blind, very fat, and asthmatical. This animal was about as bad a subject as could have been chosen for receiving chloroform, and, after administering the anæsthetic for two minutes, respiration ceased.

Thirty seconds later 2 minims of hydrocyanic acid were injected hypodermically, and artificial respiration applied for five minutes.

In one-and-a-half minutes the animal gave about eight or ten gasps, but all efforts at resuscitation failed.

Remark.—In the case of such a bad subject as this one there need not be much surprise that all efforts failed.

CASE 35.—Fox terrier, dog, five or six months old, 13 lbs. weight; somewhat too fat to be considered a good subject for anæsthesia; was chloroformed by the aid of some wadding and a towel. Anæsthesia was safely maintained for eighteen minutes, when the respirations became shallow and ceased, the heart still beating distinctly.

4.56. As quickly as possible after this was noticed 3 minims of hydrocyanic acid were injected hypodermically, and artificial respiration applied.

4.59. As there was no sign of returning life another hypodermic injection of 4 minims was given.

5.0. Respirations recommenced.

5.4. Respirations laboured owing to the overdose of acid. Reapplied chloroform cautiously.

5.7. Respirations again ceased. Removed the chloroform and continued artificial respiration.

5.8. Respirations recommenced.

5.10. Respirations laboured.

5.15. Respirations became weaker and finally ceased. Artificial respiration was continued for fifteen minutes longer, but without success.

Remarks.—This case shows that one must not be in too great a hurry to administer a second dose of hydrocyanic acid. I think

that this case might have had a successful termination had not the second dose been given.

CASE 36.—A fox terrier, bitch, eight or ten months old, was being anæsthetised by chloroform administered carefully on a sponge and towel, when suddenly the respirations ceased. A tracheotomy tube was inserted immediately, and the vapour of Scheele's hydrocyanic acid forced in by means of a Higginson's enema syringe (six full pressures of the ball being given). Artificial respiration was applied at the same time.

Two minutes after respiration had ceased, as there was no response, the vapour was again applied in the same way (twelve pressures of the ball being given). This was followed by air introduced by pressing the ball of the syringe. During the whole of this time artificial respiration was continued, the pulse being still perceptible at the femoral artery.

Five minutes after the respirations had ceased they recommenced again, but in a laboured, jerky, and spasmodic manner, the character of the pulse being decidedly stronger. This lasted for one minute, then ceased. The pulse was distinctly perceptible for two minutes longer, but all further efforts (continued for fifteen minutes) failed to resuscitate the animal.

Remark.—This method of administering the acid is a very unsafe and unwise one, as it is very difficult to control the amount of hydrocyanic acid vapour injected.

CASE 37.—A mongrel terrier, dog, good condition, 24 lbs. weight, was anæsthetised by chloroform applied on a towel and sponge, when suddenly the respirations ceased.

Fifty-five seconds later 4 minims of hydrocyanic acid were applied to the tongue, and artificial respiration commenced.

Four minutes after this the respirations recommenced feebly, then became strong, continuing for one minute, and then ceasing altogether. Efforts were continued for seven minutes longer, but without success.

CASE 38.—Fox-terrier pup, two months old, was anæsthetised by chloroform applied on a towel, and maintained in a safe state of anæsthesia for about fifteen minutes, but respirations became feeble and finally ceased.

One minute later 2 minims of hydrocyanic acid were placed on the tongue, and artificial respiration applied for some time, but without the desired effect, as no further respirations became apparent.

CASE 39.—Pug, dog, about six weeks old, 3 or 4 lbs. weight, was chloroformed, but after being under for two minutes the respirations suddenly ceased. The heart beat distinctly for one minute longer, and then apparently ceased. One minute and a half after the respiration had ceased 2 minims of hydrocyanic acid were applied to the tongue and artificial respiration begun. In a very few seconds respirations recommenced, continued for five and a half minutes, became somewhat spasmodic and laboured, and then ceased. All further efforts, continued for six minutes longer, failed to resuscitate the patient.

Remark.—In this case I consider the death to have been largely, if not solely, due to the overdose of acid administered.

CASE 40.—Fox terrier, bitch, nine or ten weeks old, 6¼ lbs. weight, very fat, and had recently eaten a hearty meal. Whilst being

anæsthetised by chloroform the respirations became very irregular and spasmodic, then ceased.

4.28 P.M. Twenty seconds later 2 minims of hydrocyanic acid were administered and artificial respirations applied. Respirations recommenced, but suddenly ceased again at 4.30.

4.33. As the breathing did not start again 1 minim more of hydrocyanic acid was placed on the tongue. After this respirations again commenced. Ammonia vapour was at intervals applied to the nostrils, but the breathing became very laboured owing to the large dose of acid. Thinking that there was no danger to be apprehended, I foolishly did not reapply the chloroform vapour to ease the respiratory efforts, and at 5.20 the head and tail became drawn together and the limbs rigid, death being due to asphyxia.

Remark.—This death was unmistakably due to the overdose of hydrocyanic acid administered.

CASE 41.—Fox terrier, bitch, ten or eleven months old, 15½ lbs. weight. Chloroform was administered by the aid of a drop bottle and cloth; during the administration the respirations became shallow and ceased. One minute later 4 minims of hydrocyanic acid were placed on the tongue, and artificial respiration was continued for ten minutes, but all efforts to resuscitate the patient failed.

CASE 42.—The patient, a fox-terrier bitch, about eighteen months old, 13 lbs. weight, was safely maintained in a state of anæsthesia by chloroform administered from a drop bottle for five minutes, at which stage the respirations became irregular and spasmodic (1.17 P.M.).

1.18. Respirations ceased completely, the pulse being distinctly perceptible. About fifteen or twenty seconds later applied 3 minims of hydrocyanic acid to the back of the tongue, but did not apply artificial respiration. Twenty seconds later the respirations recommenced, and they continued for three minutes to be strong and regular, then gradually weaker, and finally ceased. After this artificial respiration was commenced and ammonia vapour applied to the nostrils at intervals for twelve minutes longer, but there was no response.

Remark.—Had artificial respiration been commenced at once, in conjunction with the acid, I feel sure that this patient might have been saved.

CASE 43.—Cat, male, aged, weight about 6 lbs. Chloroform was administered on wadding and towel, anæsthesia being produced in one minute. Respirations became shallow, and ceased five minutes later. As soon as it was noticed they had ceased 4 minims of acid hydrocyanic (Scheele) were injected hypodermically, and artificial respiration commenced; the heart was still beating distinctly. Three minutes later the respiration appeared to revive for eight or ten times, but ceased again, and all efforts at resuscitation failed; the heart beat very distinctly for a short time longer.

Remark.—The dose of acid injected subcutaneously was decidedly too large, and I certainly think that that contributed to the want of success.

The palliative and antidotal effects of chloroform to an over-medicinal dose of hydrocyanic acid are also well marked; the appli-

cation of chloroform gives the patient much relief, prevents the clonic spasms of the limbs, and quietens the hurried breathing.

The history of the following cases, and also a reference to Cases 5, 7, 16, 19, 22, 24, 28, and 29, will demonstrate this.

CASE A.—Collie which had received an overdose of Scheele's hydrocyanic acid, viz. mx. hypodermically.

Respirations were laboured, the muscles of the limbs, etc. being in a state of clonic spasm. Chloroform was applied by means of an inhaler about ten minutes after the dose had been given, and in two minutes the animal was breathing naturally and quietly. Anæsthesia was maintained for three minutes, but as soon as the chloroform was removed the acid again began to manifest its effects. The balance was carefully maintained between them for twenty-five minutes, 1 drachm and 45 minims of chloroform being used; the patient was then sufficiently recovered to sit up. Two hours afterwards the dog was all right.

CASE B.—A Dachshund dog, eight or ten months old, the subject of epilepsy, had received an overmedicinal dose of acid hydrocyanic (Scheele).

The effect of the acid was marked by increased respiratory efforts and clonic spasms of the limbs. Within four minutes chloroform was administered on sponge and towel. In one minute the spasms ceased and respirations became regular and placid. As soon as the chloroform was removed the action of the acid became preceptible, disappearing completely when anæsthesia was produced. The balance between the two was carefully kept up for seven minutes, when, unfortunately, too much chloroform was given and respiration ceased, the heart still beating. Artificial respiration was resorted to for two minutes and respirations recommenced, but one minute later they again ceased, and two minutes after this the heart-beats could not be felt. All further efforts at resuscitation failed, death being certainly due to the chloroform.

CASE C.—A fox terrier, dog, ten months old, 15 lbs. weight, had received a large overdose (10 minims) of Scheele's hydrocyanic acid subcutaneously, and speedily manifested all the symptoms of poisoning. As quickly as possible (about two or three minutes later) chloroform was cautiously applied and artificial respiration resorted to (12.23).

12.29 P.M. Respirations were fairly strong, tranquil and regular.

12.31. Respiration ceased. The chloroform was removed and artificial respiration continued.

12.32. Respirations recommenced.

12.35. The effect of the acid on the respiratory muscles and limbs becoming manifest, chloroform was again cautiously administered, the effect being to cause the breathing to become tranquil and regular.

The balance between the two drugs was maintained as evenly as possible till 12.50 when the animal was breathing well.

12.56. Animal could walk and finally made a good recovery.

From these observations, I think it may be taken as a fair conclusion that hydrocyanic acid is of value as an antidote to chloroform, its beneficial effects being due to its property (when given in certain doses) of rapidly and violently stimulating and exciting temporarily the respiratory and cardiac centres, and so counteracting the de-

pressant and paralysing effect of chloroform. It should be placed on the back of the tongue or injected hypodermically (the former, I think, the best method in animals which breathe through the mouth) in *full* medicinal doses, undiluted with water, as soon as the breathing is noticed to be dangerous. In all the above cases Scheele's acid was used, and I think it is to be preferred before the B. P. acid on account of its extra strength and consequent rapidity of action. If the respirations have already ceased, its beneficial effects, like all other antidotal measures, are not always certain; but if it can be introduced into the system within half a minute of the cessation of respiration or pulse, and artificial respiration commenced at once, the chances of success are very good.

As compared with hypodermic injections of ether, ammonia, or strychnia, its rapidity of action gives hydrocyanic acid an unquestionable advantage, and when used on the tongue as a vapour its power of starting the respiratory mechanism, and of prolonging the efforts when they have commenced, is decidedly superior to the vapours of ammonia or nitrite of amyl. Care must be taken with reference to the dose, as if too much acid be given death may ensue from this cause. In all cases a *full* medicinal dose should be given; this must be left largely to the discretion of the anæsthetist, as the breed, age, size, and condition of the patient all tend largely to modify this in the dog and cat. About 1 minim of Scheele's acid for every seven or eight pounds of body weight is a fair average amount; the best way to apply it is by means of a drop tube with a rubber teat attached. If an overdose be given its effects must be palliated by the cautious and judicious reapplication of chloroform, and artificial respiration to combat and quieten the spasm of the respiratory muscles, until the acid has become sufficiently eliminated from the system. Another point to observe is not to be too anxious to administer a second dose until perfectly sure that the first has been futile (Cases 35 and 36 show the results of this very well). Recovery, too, when prolonged, is decidedly hastened by cautious use of the acid, as the powerful and increased respiratory efforts cause the inhalation of more fresh air and the expulsion of more chloroform vapour from the system.

I am aware that the question may be raised as to the proportion of cases that would have recovered if artificial respiration alone had been used, or even if the animal had been left to itself after respiration had stopped; but from many opportunities which I have had of observing this I am convinced that the use of the acid gives an enormously higher proportion of successes, and for this reason can confidently bring it under the notice of the profession.

ROARING, WHISTLING, AND GRUNTING.

By JAMES MACQUEEN, F.R.C.V.S., Royal Veterinary College, London.

DISCUSSIONS on symptomatic pathology are always interesting and occasionally instructive. Suggesting the base upon which conviction has been raised, they show how opinion is sometimes formed and how error may be perpetuated.

At recent meetings of veterinary societies attention has been directed to the diagnosis of defects of wind by a question concerning the importance of grunting in horses submitted to examination for soundness. Two or three societies passed a resolution implying that grunting is a decided unsoundness. Two or three agreed in thinking that grunting does not necessarily constitute unsoundness, while others arrived at the conclusion that the question should be left to the practitioner to decide for himself. This result, however unsatisfactory, may effect some good. If it shake the confidence of a few, it may reassure many, and perhaps sharpen the practice of all examiners of horses as to soundness.

Terms descriptive of defects of wind have never been remarkable for either accuracy or elegance, and although many of the old names no longer occur in modern print or practice, the reports of the discussions on grunting would seem to suggest the need for further elimination. The sounds recognised as "roaring" and "whistling" are generally ascribed to laryngeal paralysis, but the cause of "grunting" waits demonstration. When horses in England first roared or whistled is now uncertain. The older writers on farriery appear to have been familiar with many respiratory affections and with the tests of wind commonly practised to-day, but they do not mention "roaring"—a term which was not employed in this country until some time after the foundation of the Royal Veterinary College. In France roaring, or its equivalent *cornage*, was recognised by Solleysel in 1664, but Sir William Hope, who prepared Solleysel's *Parfait Mareschal* for English readers in 1696, does not use the word. Advising the buyer of horses, Hope states:—"After you are certain that the horse's flank is right and sound you are to observe if he be not a wheezer or blower. . . . . There are some wheezers or blowers which rattle and make a noise through their nose." Nor does "roaring" occur in the writings of Gibson (1719), Bracken (1749), Wallis (1775), or Hunter (1796). These farriers, following more or less closely the information contained in Hope's "Compleat Horseman," refer to wheezing, rattling, blowing, whistling, and thick-wind, and their omission of "roaring" should be attributed, not to ignorance of the sound, but rather to their having been guided by Hope's translation of *cornage*, which was then represented by wheezing, a term still found side by side with *cornage* in French-English dictionaries. To indicate an abnormal respiratory sound roaring is employed by Lawrence (1801) and White (1802), and Boardman (1805) states:—"Roaring is a singular noise which the horse makes when put into a brisk motion . . . a disease little noticed by writers, though well known to jockeys and horse-dealers." Percivall (*Elementary Lectures*, 1824) explains very fully his conception of roaring, whistling, wheezing, etc., and Youatt's book, "The Horse," 1831, contains an excellent description of roaring and other symptoms of respiratory difficulty. The publication of these works, with the first few volumes of the *Veterinarian*, marks the inception of the current usage of "roaring" and "whistling" in veterinary practice.

Of the causes to which roaring has been ascribed little need be said, but the ingenuity of most veterinary surgeons would be puzzled to name a defect—congenital or acquired—of the various tissues between the diaphragm and nose that has not been proclaimed as a probable

cause. Every observer from Solleysell downwards confesses that abnormal sounds are produced by obstruction or impediment at some part of the respiratory passage, nasal, laryngeal or tracheal, but opinion as to the origin of the exciting cause is far from unanimous. Catarrh, strangles, laryngitis, bronchitis, influenza, are most often given as the diseases which precede roaring or whistling, temporary or permanent, and amongst other assigned causes may be mentioned pharyngeal abscess, tumours, ulceration, ossification or distortion of larynx or trachea, "bands of adhesive matter," tight reining, mechanical obstruction, projections in the nasal fossæ, displaced molar teeth, pus in the guttural pouches, compression of the vagus (Dupuy), compression of left recurrent nerve between aorta and trachea (Martin, Franck), pressure by collar on left recurrent (Goubaux), enlarged bronchial glands and aortic aneurism (Ferguson, 1837), (Robertson 1885), violent aortic pulsation and dilatation (Siedamgrotsky, Sussdorf), feeding on chick vetches (Delafond, 1828), or on Indian "mutters" (Leather, M'Call, 1885), inherent tendency (Prof. Brown), impaired digestion (Sir Hy. Simpson), old age (M. Dawson), early foaling (J. Porter), heredity, and conformation; of which causes many may only be accepted as predisposing, perhaps merely coincidently, to the action of the exciting cause, while others, presumptive or purely speculative, should be regarded, at best, as problematical in face of present knowledge.

But if clinical observation has failed to establish indisputable connection between the occurrence of roaring or whistling and one or another of the conditions just named, *post-mortem* examination and experiment have proved that the majority (according to Gunther 96%) of cases of chronic roaring are immediately due to loss of power in the dilator muscles of the larynx. The causal relation of recurrent paralysis to roaring and whistling was first suggested by Dupuy, professor at Alfort Veterinary College, in 1807. In conjunction with Dupuytren, Dupuy divided the pneumogastric nerve and induced roaring. Experiments were repeated in 1815 and 1825, and the results were published with the authority of the college staff in 1827.

Ten years later (1837) John Field demonstrated the effect of section of the recurrent nerve upon respiration and the laryngeal muscles. But in 1824 Percivall observed "wasting or total absorption of one or more muscles;" and, as was the custom, Youatt quickly announced atrophy of the dilator muscles as a frequent lesion of the larynges of roarers. At first Percivall rather under-estimated his discovery, for he dismisses a suggestion that the muscular change is the consequence of paralysis, or of spasm as "baseless conjecture . . . . unworthy of comment;" while Youatt, with more foresight, maintained that laryngeal atrophy is the *effect* and not the *cause* of that which produces roaring. The influence of heredity in the causation of respiratory defects was suspected in Normandy in 1764, soon after the introduction of some Danish stallions, and later observations on the Continent and in this country have confirmed the suspicions. William Day, at one time the largest breeder of thoroughbred stock in England, asserts that roaring "in many instances is undoubtedly transmitted from parents to offspring," and that a tendency to the disease is not always discoverable by merely ascertaining what has been the health of one generation. "Like the gout roaring is

often known to lie dormant for a generation or two, only to reappear in another with increased violence." Hereditary roaring and whistling received official recognition from the Royal College of Veterinary Surgeons in 1889, when the Council furnished the Royal Commission on Horse Breeding with the names of diseases which render a stallion or mare unfit for stud purposes. About this time thirty-two witnesses, veterinary surgeons, breeders, trainers, and others of great experience were directly examined by the Royal Commissioners, and in 1890 roaring and whistling were included with the diseases "which shall disqualify a thoroughbred stallion for the purposes of the Commission."

It is noteworthy that "grunting" does not occur in the list of diseases prepared by the Royal College of Veterinary Surgeons, or in that adopted by the Royal Commission on Horse Breeding. In the evidence led before the Commissioners only a passing word is given to grunting. One witness stated that he should reject a grunting horse, because "if he grunts he generally becomes a whistler as well." Another thought grunting suggestive of roaring; and a third had "frequently tested horses that grunt which are perfectly sound in their wind under exertion." In fact, as the report shows, neither Commissioners nor witnesses were inclined to consider grunting as a defect of prime importance.

The earliest application of "grunting" to horses cannot be traced. According to dictionaries a grunt is a short groan, or a deep guttural sound as of a hog. Probably imitative originally; whence the Greek *gru*—the cry of a pig; Latin, grunnio; French, grogner; German, grunzen; Danish, grynte; Anglo-Saxon, grunan; and English, groan. Gruntling is a district name for a young pig; and on the Eastern Seaboard of the United States there is a grunting fish.

At first, the sound sometimes emitted by a threatened horse was called a groan, and its significance in the early part of this century may be gathered from Lawrence and White. Lawrence states that dealers have a method of ascertaining the existence of roaring by striking the horse under the belly. "If he groans, they say, it proves that he is a roarer." And White, referring to this test at Repositories where no other trial is allowed, says that "dealers whip the horse under the belly and make him turn suddenly round, or leap over the bar. If he is a roarer this sudden exertion causes him to groan." Percivall was probably the first veterinarian to write upon "*grunting*" in horses. His lecture on roaring (1824) contains:—"We are not only told of roarers, but we hear of pipers, wheezers, highblowers, and grunters, a cant in common use among our horse dealers . . . of the vulgar meaning of which no professional man should show ignorance." Youatt defines roaring as "an unnatural, loud grunting, sound, made by the animal in the act of breathing when in quick action, or on any sudden exertion," which, by the way, permits the inference that a grunt, like one of the tones which constitute a chord, is an essential of roaring. But it is only fair to add what Youatt also states:—"Every horse violently exercised on a full stomach, or when overloaded with fat, will grunt almost like a hog . . . . but there are some horses who will at all times emit it [grunt] if suddenly touched with whip or spur. They are called grunters, and should be avoided." At that time (1831) defects of wind were not well under-

stood. Grunting was regarded as a "species of roaring." Field had not yet cut the recurrent; and Percivall, although familiar with French books, had not at once accepted, as proved, the nervous origin of roaring and whistling. But with the growth and diffusion of veterinary knowledge, less and less consideration was given to grunting *per se*. In books paragraphs on grunting were replaced in new editions by incidental references, and in examinations for soundness the "stick and cough" tests of wind gave way to a splitting gallop, except at sale yards, where limited space, expediency, or exigency of practice encouraged a belated few to continue a method introduced, but by no means relied upon by their ancestors.

In proof of the diminishing importance of grunting, works of recognised authority in veterinary practice may be consulted with advantage; thus, Percivall, 1853:—"For the purpose of producing this sudden respiratory effort [roaring], our common practice is to make a feint or threat to strike the animal, which indeed rarely fails, should the horse have the disorder, to call forth involuntarily, the roar or characteristic grunt, and so confirm our worst suspicions. . . . Next we cough the horse; the protracted grunting or groaning of the cough, being to an experienced ear equally characteristic, may, in conjunction with the former test, be received as pretty satisfactory." Then with progressive caution Percivall proceeds:—"I regret, however, to be compelled to add that the absence of these summary tests will not, in all cases, bear us out in pronouncing the horse not to be a roarer. In a case of this kind, my common observation to the gentleman is, "I do not find your horse roars either on being struck or coughed, but you must not take this remark as a certificate that he is perfectly sound in his wind . . . to satisfy yourself of that, you had better give him a splitting gallop, and, if practicable, on soft ground or up hill; this is your only *sure* mode of detecting minor imperfections in wind."

Sir Frederick Fitzwygram, 1869:—"Grunts very similar to those given by roarers when threatened with a blow are emitted by horses with big bellies, especially by those just taken up from a straw-yard. The cause in such cases may be sudden pressure on the diaphragm from the stomach. Horses, also, which have been long in dealers' yards and have been frequently examined as to wind will sometimes grunt on being approached on account of fear of a blow. Such grunts have often no connection with roaring; but the horses which emit them should be examined as to their wind with more than ordinary care. Grunting and roaring usually go together, though as above stated they may be unconnected."

Gamgee, 1875, does not mention grunting, but:—"The diagnosis of roaring demands a careful examination of a horse through various paces and chiefly in the gallop."

Robertson, 1885, favours the stick and cough tests for roaring and whistling "where the lesion upon which the sound depends is fully established." But "in the greater number of instances, however, we find it necessary to put the animal to some severe or rapid exertion by which respiratory movements will be called into vigorous and prolonged action." Grunting "is often of considerable importance" and in some horses, "a symptom of disease." "As a pure laryngeal sound, unassociated with any affection of the chest or nervous

irritability, it ought always to be regarded with suspicion, because, if not of itself constituting unsoundness, it is indicative of a condition the probable result of which is permanent deficiency in respiration." "The quality of the grunting sound is the main consideration, and modification of pitch, high or low, usually conveys a fairly correct idea as to whether or not the larynx is affected."

Professor Williams, 1890 :—"The roarer generally has a cough which is diagnostic, being a loud, harsh, dry sound, half roar, half cough; and the generality of roarers are also grunters. In testing a horse for its wind, it is usually the practice with some to place it against a wall and threaten it with a whip; if it grunts it is further tested; if not, it is merely made to cough by pressing the larynx, and if the cough has a healthy sound the animal is generally passed sound. This plan is not always satisfactory, and the better way is to have the animal galloped, or, if a cart horse, to move a heavy load some little distance." "Laryngeal sounds, with the exception of 'grunting,' constitute unsoundness. If a horse, when struck at or suddenly moved, emits, during expiration, a grunting sound it is called a grunter. Such a sound may or may not have any connection with disease of the larynx." "Some horses habitually grunt when struck. . . . A great number of cart horses are so affected, and big horses of all breeds . . . whilst they may be quite sound in their wind." Horses with "heavy jaws" and "ill-set necks" often grunt, and so may "any horse fed for a time on bulky food." "If the grunter, however, stands the tests used to detect roaring without making any noise in its breathing, it may be considered sound."

Dr Fleming (1889) describes the cough of a horse suffering from one-sided paralysis of the larynx as "deep and sepulchral," and refers to the fact "that some horses which are not roarers will emit a sound resembling a grunt," but the noise is "produced by forcible *expiration* of air through relaxed vocal cords, and not in inspiration as in roaring." "Exciting or frightening is by no means a sure test, though often resorted to." "Some horses which are decided roarers, when galloped or otherwise exerted, will not make a noise when threatened by whip or cane. Neither is coughing a reliable or possible test in all cases."

Grunting, judged by these extracts, has failed in practice to maintain the significance attached to it originally. Youatt advises buyers to avoid grunting horses. Percivall, with more experience, doubts the value of the absence of grunting. Blaine and Gamgee pass the word in silence. Fitzwygram cautions extra care in testing grunters. Robertson hints that grunting is sometimes due to disease—which no one disputes. Williams excludes "grunting" from laryngeal unsoundness; and Fleming withdraws the sound from the sure symptoms of respiratory incompetence.

From the time of the technically uneducated farriers to the present, the motive of trying to elicit a groan or grunt from the horse has been based upon belief, however erroneous, that grunting is diagnostic of respiratory disease. But the dependence of grunting upon defect of the respiratory apparatus in horses that neither whistle nor roar has yet to be proved. Nor has anyone attempted to show why all horses that unmistakably roar or whistle do not all grunt; and as all grunting horses are not roarers or whistlers the cause of the exceptions merits

inquiry. Let the explanation be that grunting precedes and proclaims approaching roaring or whistling. The question remains unsettled, because horses may grunt at any age, and the oldest grunter may neither roar nor whistle.

But some may contend, *pendente lite*, that as grunting may lead to roaring or whistling, or, more correctly, that as young grunting horses sometimes become roarers, the veterinary surgeon must refuse, if he would sustain his reputation and escape the odium of contingency, to pass horses that only grunt. Whether or not the practitioner ever does anything of the kind is uncertain ; but if such action be usual in regard to grunting, parity of reasoning suggests its immediate extension to weak hocks, tied-in knees, long pasterns, and faulty conformation generally. Already sufficiently burdened, the veterinary surgeon would be extremely unwise to undertake the responsibility of the future soundness of any horse, in spite of the fact that roaring or whistling is not a constant sequel of early grunting. But the exquisitely captious examiner of horses may find fleeting comfort in reading a line from that much over-rated book, Oliphants' "Law of Horses":—"Grunting is an unsoundness; see roaring." Reassurance will not accompany the reference where this occurs, even in the fourth edition, 1882:—"The most general cause of roaring is a tough viscid substance which is thrown out in the shape of fluid, and adheres to the sides of the larynx," *et seq.* This rubbish on roaring is a fair sample of the veterinary contents of a law book of great influence in the courts. If its law is not more accurate, not to say up-to-date, than its pathology—which only an Ecphractic could improve—no one need wonder at the unsatisfactory termination of horse causes.

How grunting came to be considered, even by Oliphant, as an unsoundness does not appear; but two judgments on roaring show plainly enough why grunting should *not* be so regarded. In 1810 Lord Ellenborough said:—"It has been held by very high authority (Sir J. Mansfield, C. J.) that roaring is not necessarily unsoundness, and I entirely concur in that opinion. If a horse emits a loud noise which is offensive to the ear, merely from a bad habit which he has contracted or from any cause which does not interfere with his general health or muscular powers, he is still to be considered a sound horse. On the other hand, if the roaring proceeds from any disease or organic infirmity which renders him incapable of performing the usual functions of a horse, then it does constitute unsoundness." Ten years later (1817) the same judge:—"If a horse be affected by any malady which renders him less serviceable for a permanency, I have no doubt that it is an unsoundness. I do not go by the noise, but by the disease. . . . To prove a breach of the warranty the plaintiff must go on to show that the roaring is symptomatic of disease." By reading grunting for roaring the legal aspect of grunting will be ascertained.

Bearing these decisions in mind veterinary surgeons have continued to condemn as unsound horses that roar or whistle, and to refuse to reject, as unsound, horses that only grunt. And the practice has been well founded. The larynx of the chronic roarer or whistler may be relied upon to furnish evidence of *disease;* while the slightest trace of morbid change may be wanting in the larynx of the grunter, which neither roars nor whistles. But some may urge that custom has sanctioned the recognition of

grunting as symptomatic of roaring, and that testing (?) the wind by "punching and coughing" is convenient to many practising in cities. The convenience may be conceded, but the practice should be discouraged as uncertain, misleading, and at best unsatisfactory. For most observers will admit that grunting offers much variety, and that the sound emitted by a grunter cannot always be clearly defined or unmistakenly appreciated. But the grunt which some roaring horses utter when threatened has been described as a prolonged groan, unlike any other and quite different from the short grunt, of no pathological import, which sound-winded horses sometimes emit when flinching. From which it would seem that the unsound grunt should be taken as the involute of the evolute of the grunt which is not unsound. In practice, however, the difficulty of distinguishing the grunt of disease from a grunt compatible with health has been sufficient to induce veterinary surgeons to abandon the effort to fix the value of a fugitive sound of inconstant volume, length, and pitch. For this purpose an adaptation of the phonograph to the diatonic scale appears necessary, and the future may be trusted to produce a genius with enough ability to contrive an apparatus which will settle grunting differences outside veterinary societies.

Meanwhile mental attitude towards grunting might be improved if the parties to the discussion would take the trouble in practice to note the numbers of (*a*) horses that grunt and neither whistle nor roar; (*b*) horses that roar or whistle and do not grunt; and (*c*) horses that grunt and roar or whistle.

Until grunting, short or long, can be irrefutably connected with a constant lesion, whether of the respiratory or another apparatus does not matter, no one may justly condemn a horse for grunting alone. To constitute unsoundness a noise must depend upon disease, and until the cause of grunting has been ascertained nothing will be gained by sacrificing accuracy to expediency, mistaking functional flutter for structural incompetence, accepting the outcome of fear for the effect of effort, expiratory sound for inspiratory symptom, or grunting for roaring.

A CONTRIBUTION TO THE MORBID ANATOMY OF SWINE-FEVER.

By J. M'FADYEAN, Royal Veterinary College, London.

The purpose of the following article is to describe the naked eye and microscopic characters of the lesions that are commonly encountered in cases of swine-fever. I think that this object may be best attained by giving, in the first place, the results of a careful *post-mortem* examination in a series of selected cases of the disease, and then summarising under the head of the various organs the information thus obtained. With reference to the following series of cases it may be remarked that a special value belongs to the *post-mortem* notes, inasmuch as the exact date of infection of each pig was known.

CASE I.—Pig about two months old. Infected by feeding with artificial culture of the swine-fever bacillus. Died on the second day.

Post-mortem.—Slight livid skin discolouration on under aspect of abdomen.

Mesenteric glands slightly congested, but not appreciably enlarged. Glands of large intestine deeply congested, but not enlarged.

Large intestine. Intense bright red injection of the mucous membrane, particularly that covering the ileo-cæcal valve. Equally intense inflammation, with punctiform hemorrhages, throughout nearly the whole length of the colon ; no ulceration or diphtheritic deposit.

Small intestine. Moderately congested throughout.

Stomach. Mucous membrane intensely inflamed, with bright vascular injection, most severe along the great curvature and in the pylorus.

Spleen, liver, and kidneys normal.

Thoracic organs normal, save for some ecchymoses under the endocardium of the left ventricle.

Tongue and throat normal.

Body lymphatic glands normal.

CASE II.—Pig about two months old. Infected by feeding with artificial culture of the swine-fever bacillus. Died on the third day.

Post-mortem.—Marked rigor mortis. Livid discolouration of skin of abdomen.

Mesenteric glands distinctly enlarged and slightly congested. Glands of large intestine ditto.

Large intestine. Mucous membrane of cæcum and colon moderately congested. The greater part of the mucous membrane is abnormally rough, and at some places it is covered with a thin fibrinous or diphtheritic layer.

The small intestine shows congestion and swelling of the solitary follicles in the ileum.

Stomach intensely inflamed along the great curvature.

Spleen, liver, and kidneys normal in appearance.

Thoracic organs normal.

Tongue and throat normal.

CASE III.—About two months old. Infected by feeding with pieces of bowel and lung from two cases of swine-fever. Died on the third day.

Post-mortem.—Livid discolouration of skin on the under aspect of the body. Small quantity of clear straw-coloured fluid in the peritoneum. Spleen somewhat swollen ; pulp very dark, almost like an anthrax spleen ; when incised a large quantity of blood escapes.

Mesenteric lymphatic glands, as well as those of the stomach and large intestine and those at the roof of the abdominal cavity, are all in a state of livid congestion.

Intense diffuse congestion of the whole mucous membrane of the large intestine, which is of a livid colour.

Similar congestion throughout the whole small intestine. No trace of necrosis or ulceration, and no diphtheritic deposit.

Slight unequal congestion of the gastric mucous membrane, with a few petechial hæmorrhages.

Liver normal.

Kidneys intensely congested.

Lungs contain several small hæmorrhages in their substance. Prepectoral lymphatic glands large and livid from congestion.

Glands along course of aorta ditto. Bronchial glands less affected. Lymphatic glands of the body abnormally dark, but congestion not so intense.

CASE IV.—Pig about three months old. Infected by feeding with bouillon culture of swine-fever bacillus. Killed on the fourth day.

Post-mortem.—Carcase very fat. Some purple discolouration on under surface of abdomen. Peritoneum normal. Mesentric glands belonging to ileum show some cortical congestion.

Large intestine. The cæcum shows slight congestion of the mucous membrane; the first 8 inches of the colon are still more congested, and show very numerous small reddish spots. When the bowel is washed, and these are closely inspected, they appear to be slight erosions of the mucous membrane; they are about 2 or 3 mm. in diameter. They are particularly numerous on the large Peyer's patch near the ileo-cæcal valve.

Small intestine normal. Stomach normal.

Spleen, liver, and kidneys normal.

Heart and lungs normal.

Tongue and throat normal.

CASE V.—Pig about three months old. Fed with artificial culture of the swine-fever bacillus on two occasions with an interval of six days. Killed on the tenth day after the first feeding.

Post-mortem.—Carcase very well nourished. Peritoneum normal.

Mesenteric glands are slightly enlarged, and show some cortical congestion; glands of large intestine normal.

Large intestine. Mucous membrane of cæcum near the ileo-cæcal valve deeply congested. Throughout the cæcum there are numerous cicatrised ulcers, none of them larger than the surface of a split pea, and most of them very much smaller. First 3 feet of colon also deeply congested, and beset with very numerous ulcers similar to those in the cæcum.

Small intestine. Last 18 inches show marked congestion of the mucous membrane, but no ulceration. Other abdominal organs normal.

Thoracic organs normal.

Tongue and throat normal.

CASE VI.—Pig about four months old. Infected by feeding with ulcerated bowel. Killed on the twelfth day.

Post-mortem.—No obvious skin discolouration.

Superficial inguinal glands normal.

Peritoneum normal.

Mesenteric glands slightly congested, but not obviously enlarged. Glands of large intestine normal. Other abdominal lymphatic glands normal.

Spleen slightly swollen, pulp abnormally soft and dark in colour.

Small intestine. Marked congestion of the last 5 or 6 feet.

Large intestine. Cæcum shows some congestion, and numerous petechial hemorrhages at the congested points. At several places the colon also shows marked congestion and petechial hæmorrhages.

Stomach. Bright scarlet injection of the greater part of the mucous membrane.

Liver very full of blood.

Kidneys normal.

Thoracic organs normal.

Tongue and throat normal.

CASE VII.—Pig about ten weeks old. Infected by feeding with ulcerated bowel. Killed on the twelfth day, when evidently dying.

Post-mortem.—Inguinal glands swollen, but not congested.

Peritoneum covering the mesenteric glands at some places injected.

Mesenteric glands swollen and somewhat congested. Glands of large intestine normal.

Small intestine. Last 2 feet of ileum show very numerous, small, circular ulcers, mostly about 2 mm. in diameter; they have deeply congested bases, and are as distinct as if the mucous membrane had been etched away. The intervening mucous membrane is not at all congested.

Large intestine. Cæcum contains numerous ulcers, most of them about the size of a split pea. In all of them the slough appears to have separated, and cicatrisation has begun. In the first six inches of the colon there are numerous ulcers, the majority of them showing a friable-looking, greyish-yellow, necrotic centre. Throughout almost the whole length of the colon the mucous membrane shows diffuse livid congestion.

Spleen normal.

Liver and kidneys normal.

Thoracic organs normal.

Tongue and throat normal.

CASE VIII.—Pig about two months old. Infected by feeding with swine-fever bowel and lung. Died on the twelfth day.

Post-mortem.—A little livid discolouration of skin of the throat and inside of hind legs. Inguinal glands moderately congested, but not sensibly swollen.

General peritonitis; about half-a-pint of watery, deeply blood-stained fluid in the peritoneum. Intense congestion of the peritoneum covering the large intestine, with numerous ecchymoses and blood extravasations up to the size of finger nail. The peritoneum is here covered with a stringy exudate. The adjacent loops of the small intestine and the mesentery belonging to them are in a similar condition, but for the most part the peritoneum of the small bowel is much less inflamed, though everywhere it shows petechial hæmorrhages. The parietal peritoneum is for the most part normal, save that it shows hæmorrhages, which are most numerous in the region of the flanks. The peritoneum covering the stomach also shows numerous hæmorrhages.

The mesenteric glands are much enlarged, and from congestion and hæmorrhage their cut surface looks almost like spleen pulp. The glands of the large intestine are in a similar condition. Splenic and gastric lymphatic glands livid from congestion.

Small intestine. Solitary glands swollen, appearing as white opaque spots; the mucous membrane over them is intact. Mucous membrane is for the most part normal, but congested at some places.

Large intestine. The blind end of the cæcum for a length of about 4 inches is tremendously congested, its mucous membrane recalling the appearance of a piece of strangulated bowel. The mucous membrane here, and for a distance of about 8 inches along the colon, is thickly studded with ulcers of various sizes, but mostly about the diameter of a split pea or a little larger. The ulcers show a dark necrotic surface, surrounded by a well-defined whitish collar of

swollen mucous membrane. There are several ulcers on the ileo-cæcal projection. In the colon the congestion of the mucous membrane is slight until the terminal part, in which it is intense. A few isolated ulcers are present here and there as far as the middle of the colon.

Stomach. The mucous membrane at the fundus is of a bright red colour, due to intense congestion and small petechial hæmorrhages. There are no ulcers in the stomach, but at one place there is an elevation of the mucous membrane, as if from submucous infiltration, about the size of a split pea.

Spleen normal in size, pulp normal.

Kidneys show multiple petechial hæmorrhages in the cortex, especially numerous under the capsule.

Liver normal.

Lungs œdematous; a few lobules in a condition of collapse—no pneumonia.

Heart has right side distended with dark tarry blood. Some ecchymoses under endocardium of left ventricle.

Bronchial lymphatic glands congested. Prepectoral and prescapular glands ditto.

CASE IX.—Pig about ten weeks old. Infected by feeding with ulcerated bowel. Killed, when evidently dying, on the thirteenth day.

Post-mortem.—Superficial inguinal glands swollen but not congested.

Mesenteric glands, particularly the last group, distinctly swollen; some congested, others not. Other abdominal lymphatic glands normal.

Spleen normal.

Large intestine. Distinct livid congestion of the cæcum. Two distinct spots of necrosis on the ileo-cæcal valve. At several places the mucous membrane of the colon shows diffuse livid congestion.

Small intestine normal.

Stomach, liver, and kidneys normal.

Thoracic organs, tongue, and throat normal.

CASE X.—About two months old. Infected by feeding with ulcerated bowel. Died on the thirteenth day.

Post-mortem.—Livid discolouration of skin on inner aspect of limbs, and under aspect of body and head. Peritoneum normal; spleen normal in size and appearance. Mesentric glands swollen, and some of them livid from congestion. Gastric glands and glands of large intestine ditto.

Stomach. Intense hæmorrhagic inflammation of mucous membrane. Inflammation not general, but affecting mainly about one-third at convex border.

Small intestine. No trace of ulceration or necrosis, but very minute punctiform hæmorrhages in the mucous membrane. Peyer's patches and solitary glands swollen, but not hyperæmic.

Large intestine. Mucous membrane hyperæmic almost throughout, with, at some places, punctiform and petechial hæmorrhages. Numerous commencing ulcers in the shape of circular necrotic yellowish spots. Some of these are level with the mucous membrane, and others project somewhat above that and have a greyish scurf adherent to them. These commencing ulcers are only found in the

first half of the large intestine, but the last half shows the most marked congestion.

Kidneys intensely congested, with numerous punctiform hæmorrhages in the cortex.

Liver shows under the capsule a number of pin-head greyish tubercle-like points.

Lungs nowhere hepatised, but beset with multiple hæmorrhages. Bronchial glands not much enlarged, but dark in colour.

Prepectoral glands and glands of head and neck congested and livid.

CASE XI.—Pig about two months old. Infected by subcutaneous inoculation on the abdomen with material from swine-fever ulcers and lymphatic glands. Killed on the fourteenth day.

Post-mortem.—No skin eruption; carcase fairly well nourished. At the seat of inoculation, on the right side, near the linea alba and about midway between the umbilicus and the ensiform cartilage, there is a subcutaneous firm swelling about the size of hen's egg. On section this is found to be an abscess, with thin greyish fœtid pus.

Small quantity (estimated at about 1 drachm) of slightly turbid fluid in the pericardium.

Inguinal glands on right side enlarged to size of pigeon's egg, and indurated. Cut surface reddish-yellow.

Quantity of nearly transparent fluid in peritoneum (estimated at 5 or 6 ounces).

Spleen normal in size; pulp rather soft, contains two greyish-white tubercles—one about the size of an ordinary pin's head, and the other about twice as large.

Mesenteric glands slightly congested. Some of those of large intestine ditto.

Kidneys normal.

Liver normal.

Small intestine normal, save for a slight congestion of the mucous membrane at some places.

Large intestine. The ileo-cæcal projection is normal. The mucous membrane, save in the first 6 inches of the cæcum, shows scores of circular spots, the smaller about the size of the solitary follicles and the largest with the diameter of a split pea. The mucous membrane at the periphery of these spots is distinctly hyperæmic (injected). The bowel having been washed, most of these show a smooth slightly excavated surface. In a few the centre is occupied by a pin-head yellow speck, which is easily removed with the finger nail, leaving the smooth cupped surface seen in most; about the middle of the colon as many as four or five of these are present on an area equal to a five-shilling piece. The mucous membrane of the cæcum and colon is moderately congested.

Lymphatic glands at entrance to chest enlarged and firm, similar in appearance to the right inguinal gland on section.

Lungs normal, save for some areas of collapse in the anterior lobes. Bronchial glands normal.

A lymphatic gland in front of the right shoulder is enlarged to size of large hazel nut, firm and yellowish-white.

Heart normal.

CASE XII.—Pig about four months old. Infected by feeding with ulcerated bowel. Killed on the sixteenth day, when very feeble.

Post-mortem.—Slight purple discolouration of skin of abdomen and inside thighs.

Superficial inguinal glands slightly swollen and congested. Mesenteric glands and glands of large intestine congested. Gastric and hepatic glands enlarged and congested.

Small intestine normal.

Large intestine. Cæcum congested, but free from ulcers. Several ulcers on the large Peyer's patch below the ileo-cæcal valve. In the first third of the colon there are about thirty ulcers varying in size from a shilling downwards. These all show a greyish, friable, easily detached, necrotic scurf; the mucous membrane throughout the colon is in a state of livid congestion.

Stomach, spleen, liver, and kidneys normal.

Thoracic organs normal.

Tongue and throat normal.

CASE XIII.—Pig about two months old. Infected by feeding with swine-fever bowel and lung. Killed on the seventeenth day.

Post-mortem.—Skin beneath throat and neck, and along middle line of abdomen, particularly near the orifice of the prepuce, shows livid discolouration.

Inguinal glands on both sides enlarged and congested; the cut surface is mottled grey and dark red, the latter especially at the periphery of the glands. No fluid in peritoneum; glands of mesentery and large intestine livid from congestion. Peritoneum studded with numerous small hæmorrhages, particularly that covering the latter part of the small intestine. The peritoneum covering cæcum shows intense congestion and extravasation; at one place, over an extent equal to a florin, there is a deposit of reddish-yellow fibrinous lymph. The parietal peritoneum, particularly in the region of the flanks, shows numerous small hæmorrhages.

Spleen considerably enlarged; pulp dark and abnormally soft.

Kidneys enlarged one-half above the normal, and cortex thickly beset with hæmorrhages, most about the size of a small pin's head. These are almost confluent under the capsule, but they are less numerous next the boundary layer.

Stomach. The mucous membrane shows ten ulcers, most of them about the size of a split pea. These project above the normal level, and the swelling extends some little distance beyond the edge of the yellow necrotic scurf. There are numerous small petechial hæmorrhages scattered over the mucous membrane, but there is no general congestion. The gastric glands are much enlarged (one being twice as large as a garden bean), and they have a dark livid splenic colour; on section they are mottled dirty white and dark red, the latter predominating.

Small intestine. The duodenum and jejunum are normal; the ileum shows the mucous membrane with very numerous white spots, which appear to be greatly enlarged solitary glands. These are on an average about half the size of a split pea; they are white and opaque, but around some of them there is a narrow ring of injected vessels. In the last 2 feet of the ileum these are almost confluent, and there is more injection of the small vessels. At the very end of the ileum, for a length of 6 inches, the mucous membrane is covered with a yellow diphtheritic layer, and there is some necrosis over the last Peyer's patch.

Large intestine. The ileo-cæcal valve is enlarged to double the normal size and the entire mucous membrane covering it is necrotic, with the appearance of the ordinary ulcer. The mucous membrane of the cæcum, and into the colon for 8 or 9 inches from the ileo-cæcal valve, is of a deep livid colour from congestion, and it shows a great number of ulcers. Some of the single ulcers are as large as a halfpenny, but many of them are confluent. The entire surface of the large Peyer's patch adjoining the ileo-cæcal valve is covered by grey necrotic mucous membrane. The surface of the ulcers is grey and somewhat friable looking; it projects considerably above the normal level. Many of the ulcers show a central spot, either as an excavation or a projection. Throughout the colon there are a good many similar ulcers, some of them very distinctly ringed. The mucous membrane is almost generally congested, though not so intensely as in the cæcum. When the bowel is gently washed, the alimentary matters of the bowel adhere at a great many points, looking at a little distance like so many ulcers. When these adherent masses are gently detached the mucous membrane under most of them appears nearly normal, though a slight abrasion of the mucous membrane seems to be left. The rectum and the last 3 or 4 feet of the colon are free from ulceration, but the mucous membrane is at some places congested.

Liver is congested. The parenchyma shows a large number of minute greyish tubercle-like points about the size of a mustard seed. The hepatic lymphatic glands are similar to those of the stomach.

Pericardium contains about 1 drachm of clear fluid. Heart normal.

Lungs. Almost uniformly beset with hæmorrhages under the pleura and throughout the parenchyma. These vary in size from a barley grain downwards. In the left lung there is a small collapsed area in the lobe behind the heart, but there is no trace of hepatisation anywhere.

The bronchial glands are swollen and livid; the cut surface shows the congestion most at the surface of the gland. The lymphatic glands at the entrance to the chest and the axilliary lymphatic glands are enlarged and livid. The lymphatic glands of the throat are in a similar condition.

The tongue shows two necrotic areas or ulcers, the largest about the size of a split pea. The surface of the tonsils shows a number of yellowish white points; on section these are found to be the surface of pieces of necrotic tissue extending into the depth of the tonsil. The largest of them is nearly as big as a pea. On the left cheek there is an area of necrosis of the mucous membrane about the size of a split pea.

Nose normal.

CASE XIV.—Pig about ten weeks old. Infected by feeding with ulcerated bowel. Died on the twenty-first day.

Post-mortem.—Inguinal glands normal.

Peritoneum normal. Mesenteric glands slightly swollen, some of them congested. Glands of large intestine slightly enlarged and livid from congestion. Gastric lymphatic glands notably enlarged and livid throughout from congestion.

Spleen normal. Stomach normal.

Liver almost uniformly beset with minute (mustard seed) greyish-white tubercles.

Large intestine. Cæcum contains numerous ulcers, mostly about the size of a split pea or smaller, but one as large as a shilling. The first half of the colon also contains very numerous ulcers, many of them as large as a shilling and one of them as large as a half-crown. Without exception, the ulcers are covered by a greyish-yellow, dry, necrotic layer, and many show distinct concentric rings. Mucous membrane between the ulcers shows some congestion, masked by *post-mortem* discolouration.

Small intestine. For a length of about 2 feet the mucous membrane near the end of the jejunum is thickly studded with small, circular, dirty-white necrotic spots, mostly about 2 to 3 mm. in diameter; very few of these show any loss of substance.

Kidneys show multiple pin-head hæmorrhages in the cortex.

Lungs. Multiple hæmorrhages from the size of the nail of the little finger downwards.

Bronchial glands. Intense livid congestion.

Heart normal.

The tongue shows on either side, about its middle, two very distinct ulcers, with the grey necrotic mucous membrane still in position; one of these is about the size of a split pea and the other about twice as big. Each tonsil shows a number of dirty-white spots of necrosis about half the size of a barley grain and without any loss of substance.

Glands of throat livid from congestion.

CASE XV.—Pig about two months old. Infected by inoculation with bouillon culture of the swine-fever bacillus. Killed on the twenty-second day.

Post-mortem.—In the fold of skin of right flank (seat of inoculation) there is a firm tumour rather larger than a hen's egg. At one part this has broken through the skin, and here a greyish-white necrotic mass is projecting.

Inguinal glands normal, but the right precrural glands are nearly as large as a walnut, and on section show yellowish necrotic areas as large as a pea.

The large tumour at the seat of inoculation is found to be composed of a greyish-white necrotic mass, surrounded by inflammatory fibrous tissue, from which it is easily shelled out on pressure.

The cæcum shows three cicatrised ulcers, each about the size of a split pea.

Mesenteric glands normal.

Small intestine normal.

Spleen normal. Stomach ditto.

Kidneys normal. Lungs and heart normal.

CASE XVI.—Pig about ten weeks old, infected by feeding with ulcerated bowel. Killed, when evidently dying, on the twenty-third day.

Post-mortem.—Livid skin discolouration around the umbilicus and under the throat. Superficial inguinal glands a little enlarged, but not notably congested. Mesenteric glands a little enlarged and congested. Glands of large intestine normal. Gastric lymphatic glands enlarged and livid.

An easily destroyed adhesion between the outer surface of the spleen near its base and the abdominal wall.

One group of lymphatic glands (close to end of ileum) enlarged to double the normal size, and on section these show a mottled

reddish-grey and yellowish-white surface, the latter portions being firm and apparently necrotic.

Large intestine. Mucous membrane shows diffuse congestion throughout cæcum and colon. In the cæcum there are about a dozen ulcers, each about the size of a split pea; these are all covered by a canary-yellow slough. This yellow material appears to be partly surface exudate, as it projects very distinctly above the level of the surrounding mucous membrane, in most cases with a flat, but in some with a rounded, summit.

There is an irregular ragged ulcer, with a greyish crust, on the side of the ileo-cæcal valve, and the large Peyer's patch below the valve is dotted with pin-head superficial yellow points of necrosis. Scattered through the colon, somewhat sparsely, there are ulcers similar to those in the cæcum. A few of them have lost the slough and are partially cicatrised.

Small intestine. About 15 inches from the pylorus there is a distinctly crater-like ulcer (tuberculous) about the size of a split pea, and a few inches nearer the pylorus a yellowish-white submucous infiltration of about the same size. Small intestine otherwise normal.

Stomach normal.

Spleen contains about twenty tumours varying in size from a hazel nut downwards. These have the characters of tuberculous tumours. On section they show a yellow necrotic centre and around that, but not sharply separated from it, the substance of the tumour is of a brighter red tint than the splenic substance.

Liver and kidneys normal.

Lungs thickly beset with petechial hæmorrhages.

Bronchial glands neither enlarged nor congested.

Tongue and throat normal.

CASE XVII.—Pig about four months old. Infected by feeding with ulcerated bowel. Killed on the twenty-fifth day.

Post-mortem.—No eruption on skin. About 2 ounces of clear watery fluid in the peritoneum; peritoneum normal. Mesenteric glands slightly congested; glands of large intestine normal.

Large intestine. Cæcum contains numerous ulcers, varying in size from a sixpence downwards; all of these are partially cicatrised, but none completely. The floor of the ulcer is depressed, and contrasts by its deeper vascular tint with the surrounding mucous membrane; the mucous membrane circumscribing the ulcer slopes inwards. Most of the ulcers are partly covered by a yellow easily detached material, like thick pus; beneath this covering the floor of the ulcer shows distinct granulations. A few exactly similar ulcers are found in the first half of the colon.

Small intestine. Terminal part of ileum shows numerous cicatrising ulcers, similar to those of the large intestine, but with the healing process rather further advanced; most of these ulcers are about the size of the surface of a split pea, but some are larger. They are most numerous in the last 6 inches, but are found as far as 4 feet in front of the ileo-cæcal valve.

Stomach normal.

Spleen normal.

Kidneys normal.

Liver normal.

Small patch of collapse in the right lung ; lungs otherwise normal. Bronchial glands normal.

Heart normal.

Inguinal glands normal ; glands in front of shoulder normal.

Mouth and throat normal.

CASE XVIII.—Pig about two months old. Infected by feeding with swine-fever bowel and lung. Killed on the twenty-seventh day.

Post-mortem.—Carcase emaciated ; skin over abdomen somewhat livid in colour.

Mesenteric glands much enlarged, not much congested, but on section they show numerous dry, firm, yellowish-white necrotic-looking areas ; some of them almost as large as a pea.

About 1 drachm of fluid in the peritoneum. Parietal peritoneum normal ; as also that of the large intestine ; the peritoneum covering the ileum is inflamed and rough ; at one part there is a recent easily broken down adhesion between opposite sides of a knuckle of intestine.

The gastric lymphatic glands are swollen but without necrotic areas; those of the large intestine are exactly similar to the mesenteric glands.

Spleen normal in size and appearance.

Kidneys normal.

Liver normal save for the presence of two hydatid cysts.

Large intestine. The cæcum contains a number of partially healed ulcers ; these are mostly circular in outline, and present themselves as shallow erosions with very well-defined edges. The floor of the ulcer is flat, and in many it is more or less completely covered by a yellow easily detached pus-like material ; the mucous membrane forming the edge of the ulcer slopes a little inwards, as if the epithelium were spreading over the ulcer ; the mucous membrane immediately around the ulcer is somewhat hyperæmic. In the colon there are a few similar ulcers ; throughout it the submucous follicles with the central gland are unusually prominent. Several ulcers heie are as large as a sixpence, and nearly or completely re-covered by epithelium ; these have a well-defined circular outline, and the new epithelium is a bright pink from injection of the underlying vessels.

Small intestine. The duodenum and jejunum are normal. In the last 3 feet of the ileum there is most extensive ulceration ; some of the ulcers are circular, but many are irregular. Here again the lesion is a true ulcer with a level base apparently corresponding with the submucous layer. The ulcers are as distinct as if the mucous membrane had been etched away ; the floor of the ulcer is grey, and in large part covered by a thin yellow pus-like material. The intervening mucous membrane of the bowel is pink from congestion. The edge of each ulcer slopes a little towards the floor, and at the very edge the mucous membrane is of a brighter pink from congestion than elsewhere. In the last 5 inches of the ileum almost the entire mucous membrane has been removed, and only a few small islands of it are left, standing up above the level of the ulcerated surface.

Stomach normal.

Pericardium contains a few drachms of clear fluid.

Heart normal.

Considerable amount of collapse in anterior lobes of lungs ; otherwise normal.

Bronchial glands normal. Inguinal glands normal. Glands in front of shoulder slightly enlarged. Glands in intermaxillary space enlarged on both sides, firm, and on section showing yellowish-white dry necrotic-looking areas. Surface of each tonsil ulcerated; the outline of the ulcer is irregular, its edges are thickened, and its surface is covered with a yellowish slough.

Tongue normal.

CASE XIX.—Pig about two months old. Infected by subcutaneous inoculation on abdomen, with material from swine-fever bowel ulcers and lymphatic glands. Killed on the thirtieth day.

Post-mortem.—Carcase fairly well nourished. A few small superficial brown scabs on the abdomen and inner surface of thighs. At the seat of inoculation on the right side of the umbilicus there is a swelling about the size of a pigeon's egg; when cut into, this is found to contain centrally some greenish-yellow thick pus. The inguinal gland on the same side is enlarged to the size of a hen's egg and very firm; on section the greater part of the gland appears to be necrotic. The necrotic part has a mottled yellowish-white and pink surface and a dry appearance; it is very sharply separated from the rest of the gland, which is grey and very succulent, but not abnormally vascular. Glands of small intestine normal; those of large intestine normal.

Peritoneum normal.

Spleen, normal in size, contains eight tumours varying in size from a large pea to a barley grain; these are firm and yellowish-white on section; the greater part of each tumour appears to be necrotic but not caseous.

Large intestine. The mucous membrane of the cæcum when gently washed shows a considerable number of cicatrising ulcers, somewhat irregular in shape and size, though most of them are about the size of the surface of a split pea. These are quite distinct from the surrounding mucous membrane, by reason of a pinkish tint from vascularity. The surface of most of them appears a little depressed and not so smooth as the surrounding mucous membrane. One or two of these are present in the colon also. The ileo-cæcal valve is normal.

Small intestine. Mucous membrane somewhat congested; no trace of ulceration.

The stomach and its lymphatic glands are normal. Kidneys normal.

Liver normal save for a small spot, which appears cirrhotic, at the upper part of the right lobe. Hepatic lymphatic glands normal.

Pericardium contains a few drachms of clear watery fluid. Heart normal.

Lung. A few collapsed lobules in the right lung, otherwise normal.

Bronchial glands normal.

In the right lumbar region a lymphatic gland is enlarged to the size of a hen's egg, and has characters similar to those of the inguinal gland on the same side, save that the entire gland is involved and the cut surface is more pink.

CASE XX.—Pig about ten weeks old (at the beginning of the experiment). Infected by feeding with ulcerated bowel. Killed on the fortieth day.

It had not grown any since the beginning of the experiment, and

now presented a very unthriving appearance, although it had recovered its appetite and appeared lively.

Post-mortem.—Skin harsh and dry in appearance. Depilation around the eyes and at some places on the body.

Inguinal glands normal. The last of the mesenteric glands (nearest the ileo-cæcal valve) is double the size of a hazel nut. It has a firm consistence, and on section it is found to be almost entirely necrotic, the cut surface being dry and yellowish white in colour. The other mesenteric glands and the lymphatic glands of the large intestine appear normal.

Large intestine. Cæcum normal. Colon shows some diffuse livid congestion of its mucous membrane, but no trace of ulceration there or elsewhere in the large intestine.

Small intestine. In the ileum the mucous membrane shows distinct injection of its small vessels in many places; this is more marked in the rest of the small intestine, particularly in the duodenum and the first part of the jejunum.

Stomach normal.

Spleen, liver, and kidneys normal.

Thoracic organs normal.

Tongue and throat normal.

Mouth.—In a small proportion of fatal cases lesions are present on the tongue, in the form of a sharply defined necrosis of the mucous membrane, circular or oval in outline, and usually seated on the upper third of the organ (fig. 1, p. 132). The necrotic part is dry looking and greyish in colour, and recalls the appearance of the better known ulcer of the large bowel. Doubtless in some cases the necrotic part is thrown off as a slough, and ultimately replaced by a smooth cicatrix, but it has never been my lot to meet with lingual lesions in this stage.

Disease of the tonsils must be reckoned among the rare lesions of swine-fever. Here, again, the lesion is a necrosis, and it apparently has its starting-point in connection with the crypts of the tonsil. The necrosis may extend for a considerable depth, and the dead tissue may be detached, leaving an irregular ulcer.

In only one instance (Case XIII.) have I encountered a lesion on the mucous membrane of the cheek, and that had a similar appearance to the lingual ulcer.

These buccal lesions are probably more frequent than might be inferred from the fact that most authors fail to mention them, for in practice the mouth is only exceptionally examined at the autopsy. Failure to detect them cannot be regarded as a serious oversight from a diagnostic point of view, for it is in the highest degree improbable that they ever occur without the simultaneous presence of equally or more characteristic lesions in the bowel.

Stomach.—In very acute cases of swine-fever the lesion here may present itself as a most intense gastritis diffused over a large area of the mucous membrane. The part most frequently affected in this way appears to be the pylorus and the lower part of the organ (along the great curvature), but sometimes the entire mucous membrane is inflamed. The colour of the inflamed membrane is sometimes a bright red, sometimes livid, and sometimes it is associated with multiple petechial hæmorrhages, or with less numerous but larger

blood extravasations. This intense inflammatory hyperæmia of the gastric mucous membrane is generally found in cases that die within a few days after infection with a large quantity of virulent material

FIG. 1.—TONGUE OF PIG WITH TWO SWINE-FEVER ULCERS (the Ulcer on the left side of the tongue is almost out of view).

administered by the mouth, but sometimes the same condition may be present as late as twelve or thirteen days after infection.

In a small proportion of cases the gastric mucous membrane is the seat of a sharply defined necrosis, producing a lesion that closely resembles the ulcer of the intestine. It seldom happens that more than two or three such ulcers are found in the stomach.

Small Intestine.—Next to the large bowel this is the part of the alimentary canal in which lesions are most frequently present. In animals dying early the mucous membrane may be in a condition of superficial inflammation, attended with almost general injection of the small vessels. Sometimes it is dotted with minute hæmorrhages into its substance, and more frequently the solitary glands and Peyer's patches are swollen, especially in the terminal part of the ileum. But the commonest lesion of all in the small intestine is a diffuse diphtheritic inflammation, or a necrosis of the mucous membrane, generally in the form of small round spots (rarely as large as the surface of a split pea), which very promptly became converted into circular ulcers by the detachment of the slough. Sometimes this ulceration is so extensive in the latter part of the ileum that only

remnants of the mucous membrane are left (fig. 2); these then appear as irregular pale islands standing above the level of the red ulcerated surface. Whatever may be the reason, the necrotic mucous membrane seems to be much more promptly cast off here than in the case of the

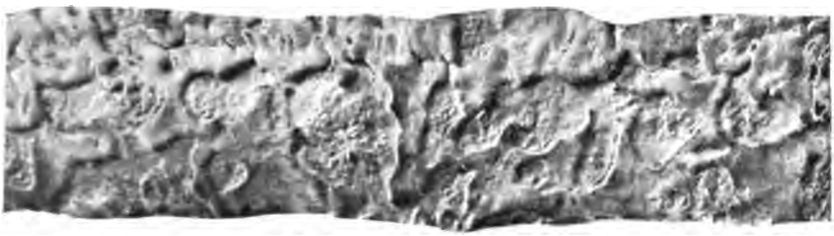


FIG. 2.—MUCOUS SURFACE OF ILEUM OF PIG, showing extensive Swine-Fever ulceration. The parts standing in relief are the remnants of the mucous membrane.

large bowel, and cicatrisation in favourable cases appears to proceed more rapidly. Sometimes the necrosis involves only the villi and a thin superficial stratum of the propria mucosæ and glands of Lieberkühn, but in other cases it involves the entire thickness of the mucous membrane.

The diphtheritic lesion is simply a diffuse superficial necrosis of the mucous membrane, accompanied by the coagulation of a thin layer of croupous or fibrinous exudate on its surface. As a rule these lesions (diphtheritic layer and discrete ulcers) are absent from the first half of the small intestine, and frequently they are found only in the last few feet of the ileum.

Large Intestine.—Experience seems to justify the belief that in swine-fever lesions are of constant occurrence in the large intestine, and that certainly cannot be said of any other organ. The alterations encountered in the large bowel vary greatly both in extent and nature.

In very acute cases (dying within two or three days after infection) the only lesion present in this part of the bowel may be a diffuse superficial inflammation accompanied by marked congestion, and with nothing to distinguish it from an enteritis set up by the presence of an irritant poison of a chemical nature. Fortunately, however, for diagnosis, death at this stage of the disease is very rare. In the twenty cases of which details have already been given, there were only two (Nos. I. and III.) in which diphtheritic lesions or actual ulcers were not present in some part of the large intestine.

The diphtheritic lesion of the large intestine may be found in a very well-marked form in pigs within three or four days after infection. It may affect almost the whole of the cæcum and colon or be confined to a few irregular patches, and it may or may not be associated with circumscribed areas of necrosis (ulcers). When very extensive it appears to denote a very large dose of the agent of infection, or a feeble resistance on the part of the individual. Probably the diphtheritic lesion is always preceded by a stage of inflammatory hyperæmia, following upon which the surface of the mucous membrane assumes a greyish tinge and becomes abnormally rough. When

fully developed the surface of the membrane is covered with a thin adherent greyish or yellowish exudate.

Microscopic examination of a piece of bowel in this state shows that the lesion is essentially a diffuse superficial necrosis of the mucous membrane, with the coagulation of a fibrinous exudate in its substance and on its free surface. The glands of Lieberkühn can still be made out, but their outlines are distorted and their epithelium in large measure detached. The necrosis which they and the other elements of the membrane have undergone is manifested by the loss of the affinity of their nuclei for the ordinary nuclear stains. As a rule the necrosis does not appear to be preceded by any notable escape of leucocytes, and, indeed, this absence of phagocytary reaction appears to be a marked feature of swine-fever lesions in general.

Probably most of the cases in which there is very widespread diphtheritic changes in the large intestine soon end fatally, but sometimes the animal lingers on for weeks, or perhaps even months. The diphtheritic layer is then lost, and the mucous membrane acquires a coarse rough surface, while the other coats become thickened to such an extent that the bowel does not collapse when it is removed from the body.

By far the commonest and most important lesion of swine-fever is the so-called ulcer of the large intestine. Its importance arises from the constancy with which it occurs in all save very acute and rapidly fatal cases, and from the fact that the ulcer has characters by which it may without difficulty be distinguished from other intestinal lesions

FIG. 3.—PORTION OF COLON OF PIG WITH VERY NUMEROUS SWINE-FEVER ULCERS.

met with in the pig. In the earliest stage at which the ulcer is usually encountered it is simply a sharply defined, approximately circular necrosis of the mucous membrane, the dead tissue being still retained in position. The ulcers vary greatly in point of size and still more in numbers in different cases. Sometimes almost the entire mucous membrane of the cæcum and colon is thickly studded with ulcers as

the piece of bowel shown in the accompanying figure (fig. 3), but in other cases only a few are present. The cæcum and the first few feet of the colon are the commonest seats of the ulcers, but sometimes they occur as far back as the rectum. Frequently, though by no means constantly, the ileo-cæcal projection is ulcerated, but that and the whole of the cæcum may be free from ulcers although these are present in the colon.

The ulcers commonly vary in diameter from that of a split pea to that of sixpence, though they may reach the size of a florin. Their surface is greyish, yellowish, or even black, and when the necrosis is recent the surface of the ulcer is firmer and drier-looking than that of the surrounding mucous membrane. Sometimes the surface of the necrotic patch is only a little above the normal level, but at other times it projects considerably, and it may be covered with a thicker or thinner diphtheritic deposit. In ulcers of considerable size the surface often shows irregularly concentric rings.

Microscopic examination of a recent ulcer shows that here again the lesion is essentially a necrosis, which as a rule involves the whole thickness of the mucous membrane and part of the submucous coat. The necrosis appears to begin at the surface of the bowel, and the fact that the ulcer is generally round in outline is attributable to the regular extension of the lesion around the spot at which it started. The necrosis does not seem to be preceded by any very marked congestion, but no doubt the usual vascular phenomena of inflammation are present at the outset, and just before actual death of the glandular layer takes place it becomes saturated with an inflammatory exudate, of which a little may escape on the surface and coagulate there as a diphtheritic layer.

As in the lesions previously considered, the primary inflammation is not attended by a profuse migration of leucocytes, but when actual necrosis of the mucous membrane has taken place, a more or less abundant small-celled infiltration sets in at the line of junction with the living tissue.

As one would naturally expect, the necrotic part, if the pig survives, is generally cast off, but the rapidity with which this is effected appears to vary greatly. Sometimes the slough is still in position, and shows traces of its original structure, when the changes in the submucous coat beneath it indicate that it has been in existence for some weeks, but in other cases cicatrised ulcers with the slough cast off are found as early as nine or ten days after infection. The necrotic part appears to be detached mainly through the agency of an inflammatory reaction at its base, and when this has been effected cicatrisation begins, the epithelium gradually growing in from the margin of the ulcer. Needless to say the glandular layer of the mucous membrane is not restored, and when cicatrisation is complete a smooth shining depressed scar marks the seat of the original ulcer. These cicatrices are likely to be overlooked at the *post-mortem* examination unless a special search is made for them after the mucous membrane has been washed.

The depth to which the necrosis extends into the wall of the bowel varies greatly. Generally it involves the whole thickness of the mucous membrane and part of the submucous coat, but sometimes it does not reach the muscularis mucosæ, and

in other cases it extends as far as the outer muscular coat. When the necrosis extends well into the submucous coat, and a productive inflammatory reaction takes place beneath the dead stratum, the deeper part of the submucous coat and the muscular coat become markedly thickened, and in this way ulcerous tumours projecting much above the normal level of the mucous membrane are formed.

Perforation of the bowel wall through extension of the necrosis to the peritoneal coat is a very rare lesion in swine-fever.

Before leaving this part of the subject it may be well to utter a word of caution against the danger of mistaking a condition of simple plugging of the crypts on the side of the ileo-cæcal valve for ulceration. Not infrequently, especially in old pigs, these crypts contain masses of what appears to be inspissated secretion, which may be squeezed out of them under slight pressure between the finger and thumb; indeed, this condition is so common that it can hardly be considered an abnormality, and, in any case, it has nothing to do with swine-fever. Sometimes, however, though not so frequently as is generally supposed, these plugged follicles form the starting-point of an actual necrosis, leading to the formation of an ulcer on the side of the ileo-cæcal projection.

Perhaps it may not be amiss to also mention here the small branched glands, somewhat resembling the glands of Brünner, which in the large intestine of the pig are placed in the submucous coat, embedded in a little mass of lymphoid tissue. Each gland has a duct which passes between the glands of Lieberkühn and opens as a pore, distinctly visible to the naked eye, on the surface of the mucous membrane. These glands appear as round whitish spots in the bowel wall, and they must not be mistaken for ulcers, although, exceptionally, necrosis and ulceration start in connection with them.

Liver.—In some cases of swine-fever this organ is the seat of a very interesting lesion, viz., a multiple miliary necrosis. The areas of necrosis are sometimes present in almost every lobule, and they might easily be mistaken for miliary tubercles. To the naked eye they appear as greyish opaque specks about the size of a mustard seed, and when magnified they present the appearance shown in Plate III., fig. 4. The lesion is interesting as an example of pure necrosis unproceeded by any migration of leucocytes. At the margin one can still distinguish the outlines of the liver cells, whose necrotic condition is made manifest by the fact that their nuclei are unstained, but towards the centre of the spot the normal elements of the lobule are no longer recognisable. These necrotic areas contain large numbers of the swine-fever bacillus in pure culture.

Spleen.—As a rule, in swine-fever the spleen is perfectly normal in appearance. In very malignant cases it may be so much enlarged and softened as to remind one of an anthrax spleen, and it may contain circumscribed areas of necrosis.

Lymphatic Glands.—In very malignant cases of swine-fever the lymphatic glands are generally enlarged and congested, the congestion often being accompanied by hæmorrhages. In the majority of cases, however, the only lymphatic glands that present any abnormality are those found in the abdomen—gastric, hepatic, splenic, and intestinal. All or any of these may be much enlarged, and so deeply congested

as to resemble spleen pulp on section. But in many cases, if not the majority, even these groups show but little congestion. The mesenteric group is, next to the bowel, the most constant seat of the bacilli in natural cases of swine-fever, but the presence of the bacilli there may not be attended with great vascular disturbance. These glands are generally somewhat swollen and juicy in the early stage of the disease, and at a later stage they may contain areas of firm dry necrosis up to the size of a pea or larger. These changes are most frequent in the last of the mesenteric glands—those on the track of the lacteal vessels coming from the terminal part of the small intestine.

Peritoneum.—It is in only a small proportion of cases that the peritoneum presents any abnormality. It may be generally inflamed, with a considerable quantity of exudate in the peritoneal cavity, and numerous petechial hæmorrhages are sometimes present on it. The inflammation appears to be generally set up by the extension of the bowel lesions at some point to the visceral peritoneum, and the inflammatory exudate may contain swine-fever bacilli in pure culture, or these may be associated with accidental organisms that have reached the peritoneum from the bowel.

Kidneys.—As a rule these organs appear normal, and the only lesions that I have encountered in them are multiple hæmorrhages into the cortex.

Heart.—Save for occasional sub-endocardial ecchymoses in malignant cases the heart presents no abnormality, and the blood throughout the body is quite normal in appearance.

Lungs and Pleura.—The only lesions that are frequently encountered in the lungs of pigs that have died or been killed while suffering from swine-fever are small hæmorrhages and collapse. Multiple petechial hæmorrhages under the pleura and throughout the lung substance are frequently present in acute malignant cases, and small areas of collapse are still more common when the disease runs a lingering course. This collapse appears to be due simply to the feebleness of the respiratory movements, and cannot be regarded as in any way an essential lesion of swine-fever. Actual pneumonia, whether catarrhal or croupous, is a quite exceptional occurrence, and it is very probable that it is generally, if not always, a complication of the disease, and not caused by the swine-fever bacillus.

In support of the statements just made it may be pointed out that in not one of the twenty cases of which details have been given in an earlier part of this article was there any pneumonia, and I am informed by Messrs Cope and Duguid that, among the numerous swine-fever organs that pass through their hands at the Board of Agriculture, they rarely meet with pneumonic lesions.

The term pneumo-enteritis, which was originally suggested by Dr Klein as a fitting designation for this disease, must therefore be pronounced a misnomer.

Regarding the occurrence of pleurisy it need only be said that it is still rarer than pneumonia, and that when it does occur it is also probably a complication, and not caused by the swine-fever bacillus.

Skin.—In the virulent rapidly fatal form of the disease a rash is often present on the skin. In rare instances the skin shows almost everywhere a livid discolouration, but more frequently this rash is confined to the ears, the under surface of the body, and the inner

aspect of the limbs, the skin in these positions being mottled with livid or dark red spots. The discolouration appears to be due to a venous congestion of the cutaneous vessels, and it is not associated with any swelling of the skin or subcutaneous tissue. In the great majority of cases of swine-fever, the disease runs its course without the development of any abnormality in connection with the skin.[1]

DESCRIPTION OF PLATE II.

FIG. 1. Ileum of a pig, killed on the twelfth day after infection, showing numerous small pitted ulcers, two of which are marked *a*, *a*.

FIG. 2. Gastric mucous membrane of pig, killed on the seventeenth day after infection; *a*, *a*, two ulcers with grey rough surface, projecting above the normal level; *b*, a third ulcer with a smoother flat surface, and surrounded by a ring of swollen mucous membrane.

FIG. 3. Colon of pig, killed on the twenty-third day after infection, showing ulcers, two of which are marked *a*, *a*.

FIG. 4. Liver of pig, killed on the twenty-first day after infection, showing an area of necrosis (*a*) in a lobule.

FIG. 5. Colon of pig, dead on the third day after infection; *a*, diphtheritic exudate on surface; *b*, partially necrotic mucous membrane, with outline of glands still recognisable; *c*, submucous coat.

FIG. 6. Colon of pig, dead on the fifth day after infection; *a*, diphtheritic exudate on surface; *b*, necrotic mucous membrane; *c*, submucous coat.

FIG. 7. Colic ulcer of pig, killed on the twenty-third day after infection; *a*, slough in process of detachment; *b*, base of slough infiltrated with leucocytes; *c*, mucous membrane; *d*, submucous coat; *e*, muscular coat.

FIG. 8. Colic ulcer of pig, killed on the sixteenth day after infection. Letters as in Fig. 7.

CATARACT IN THE HORSE.

By Veterinary-Captain F. SMITH.

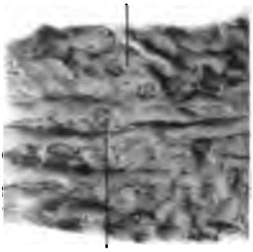
DEFINITION.

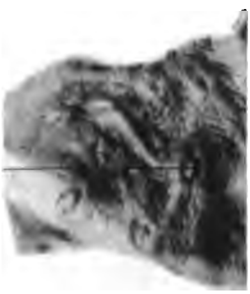
CATARACT may be defined as a partial or complete opacity of the crystalline lens. It is not necessary to divide cataracts into capsular, lenticular, and capsulo-lenticular, as it is probable a cataract is always lenticular; further, the division would indicate that no difficulty is experienced in accurately determining one kind from the other, whereas this is certainly not the case; and, finally, whether the opacity be of the lens or its capsule is of no moment from a practical point of view.

GROWTH AND NUTRITION OF THE LENS.

The nutrition of the lens is peculiar; in development it arises from the same structure that furnishes the skin, and this is a point worth remembering in considering the changes which occur in it as the result of age. The whitening of the hair and wrinkling of the skin of

[1] I remember seeing in the possession of the late Professor Walley some pieces of skin with circular greyish patches of necrosis, which he regarded as examples of cutaneous swine-fever lesions, and which certainly had a remarkable resemblance to the ulcers of the large intestine.





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are a cause of trouble. Injuries to the cornea, especially those leading to suppuration, are often followed by opacities of the lens.

An attempt to arrange these causes in the order of their frequency can only, in the present state of our knowledge, be based on the process of guessing and the experience of the individual.

We cannot, or should not, overlook the eye the seat of a previous attack of periodic ophthalmia, nor can we avoid seeing scars on the cornea; yet of all the cataracts I have seen these two causes, I am sure, can only account for a small proportion of the cases. The eye in which I have most frequently found cataract, is one which from its external appearance is perfectly healthy, with a bright transparent cornea, a freely moving iris, in fact no evidence whatever of inflammatory trouble having at any time existed within or without.

Such evidence, then, excludes ophthalmia, either traumatic or idiopathic, from any considerable responsibility for the number of cases which exist, and we are driven back on heredity and age.

These two causes are probably responsible for the majority of the cataracts met with, but any attempt to define their relative proportion would be misleading in the present state of our knowledge; each practitioner will form his opinion from his own experience. My practice extends to young horses and animals in the prime of life, I cannot therefore regard senile decay as a fruitful source of the cataracts I have met with.

We have no idea at present at what age senile changes are most likely to occur in horses' eyes, nor, for that matter, do we know at what age senile changes occur in the limbs. That the majority of horses are old between fifteen and seventeen is no evidence that senile changes occur at that time. This question, in fact, cannot be studied, so far as the limbs are concerned, without inquiring into the nature of the work the animal has performed.

To determine senile changes in the lens is another matter, and one which should be capable of elucidation; in fact, it is probable that by this means we may solve a problem sometimes put by the curious and thoughtful, viz., "When is a horse really old?"

Without any stronger grounds than those named above, I regard the majority of cataracts in the horse as being hereditary, while the old-fashioned theory that an attack of ophthalmia is absolutely necessary as a prelude to the production of cataract, is probably nowhere now held to be true.

DIAGNOSIS OF CATARACT.

The diagnosis of cataract is, ordinarily speaking, a matter of great simplicity and certainty; it is, therefore, a deplorable state of affairs to read and hear of differences of opinion on a subject susceptible of absolute accuracy. Difference of opinion respecting spavins and ringbones will exist until we utilise the Röntgen ray for their determination, but no such excuse exists as regards cataract. For many years past an instrument has been known, a glance through which is capable of settling with accuracy the existence or non-existence of opacities, and it does not redound to our credit as a profession that we have not adopted the ophthalmoscope more widely, but rather trusted to the black hat and our own often imperfect eyesight.

Considering the struggle for existence, the fight between the

qualified man and the quack and chemist, it is remarkable that we have been so blind to our own interests as not to see that progress with the times is essential to success; that the ready adoption of physical or chemical appliances as an aid to diagnosis marks us as not only moving with the times, but puts us at once above the head of the quack and the empiric. We may affect to sneer at the "'scope" age, but so long as the instruments are of the practical value of ophthalmoscopes, phonendoscopes, and others used in surgery and medicine, we need not hesitate to introduce them into veterinary practice. If we are to crush out the intruder from our ranks we must show the public that we are professionally his superior in learning, in technique, in skill, in manipulation, in soundness of judgment, and that we possess methods of diagnosis of which he has never even heard the name. Who can believe that thus armed we have anything to fear from without?

There are four methods of examination for cataract:—

1. Direct vision with the unaided eye.
2. Ophthalmoscopic examination.
3. Oblique illumination.
4. Catoptric phenomenon.

Of the first method I have nothing to say; the process is well known. It is undeniably valuable, but it does not afford undoubted evidence of freedom from disease.

In the ophthalmoscopic method the lens is examined by reflected light, and its transparency or otherwise can be seen at a glance.

The method of examination is simple; with the ordinary mirror of the ophthalmoscope, light is reflected into the eye from any available source. This can be done in the stall or box with the light from a neighbouring window or door. No precautions of any kind are required, excepting to keep the eye under examination away from the source of light. In examinations for soundness I do the eyes at the stable door, but at a few feet from it, inclining the head towards me so as to put the eye under examination in the shade, and taking my light from the door.

Neither atropine nor artificial light are required, nothing in fact but the little mirror, daylight being used for the purpose of illumination. It is this entire absence of any arrangements for the purpose of examination which renders the method so suitable for veterinary work. When I first commenced the use of the ophthalmoscope I was led to believe that a dark box and lamp-light were necessary accessories, but in course of time I found they could be abolished with advantage, and I now use daylight and any convenient part of a stable or passage.

The rays of light impinging on the mirror are reflected into the eye, which is turned away from the source of light, the operator standing at his ordinary focal length from the eye, say, 8 to 12 inches. If the rays are properly directed on the eye, and the observer's eye corresponds to the hole in the mirror, the entire eye under examination is found illuminated with a peculiar yellow or greenish-yellow light, and at this moment the observer is looking at the illuminated lens, the brilliancy being due to the reflected light from the tapetum.

If the lens is free from disease it is transparent over its entire

surface; if, on the other hand, it is affected with cataract, the deposits show up as dark specks or "blurrs" on the highly illuminated ground. The reason why they show up as dark bodies is because they are in shadow, through the light being reflected from the fundus of the eye.

I have said the deposits are *dark*, but they are not black, for a certain amount of light passes through them. Depending on this amount is the depth of the darkness. As a rule the dark blotch or dot is so well marked that it is seen at a mere glance, but I have recently met with a case where the opacity on ophthalmoscopic examination was so slight, that it might have been overlooked, though the same deposit could at once be seen by the direct method. This is the only exception I have yet met with, but it shows that the ophthalmoscopic and direct methods may be advantageously combined.

If the lens is very opaque, it is evident that simple inspection by the eye is sufficient to discover it without the aid of any physical appliance. But as we shall presently have to point out, opacities affecting the lens of the horse are not usually diffused but circumscribed; about the size of pin-points or pin-heads are much more common than larger ones, and it is in the detection of these that differences of opinion exist.

No objection can be urged against the use of the ophthalmoscope on the score of slowness, for a complete examination of a lens may be made in four to six seconds, and, excepting in cases of disease, I rarely take longer.

The next method of examining the lens for opacities is by oblique illumination. It is a process of which I have little experience, but it is well spoken of by human oculists. It may be practised by day or artificial light; whichever source is used the rays are focussed on the eye by means of a convex lens, and the surface of the crystalline examined. Opacities by this means are easily seen and in their true colour, viz., as white blotches, streaks or dots.

It is very seldom that this method need be employed; I shall presently recommend its use in one class of case only.

By means of the catoptric test carefully and intelligently employed, a good examination of the lens may be made. The principle of the method is that a flame, such as that from a candle, is reflected from the surface of the cornea, and from the anterior and posterior surface of the lens.

The reflected images differ in size and brilliancy, but each should be distinctly and sharply seen at any point on the surface of the lens and cornea. The corneal reflection is the brightest and largest, but it does not concern us here; the next image is small and upright, while the third is still smaller but inverted. The latter is reflected from the posterior surface of the lens, the former from the anterior surface. In applying the test the whole area of the lens should be examined both in a horizontal and vertical direction, and each reflection should be closely watched. In a healthy lens the image of the flame should remain sharp and single, but in a lens affected with opacity the least trace causes the image to blurr and even become double as it passes over the opaque area or spot.

It is therefore the blurred image which is looked for, and unless great care is exercised it may readily escape observation, as it is only exhibited just at the position of the opacity. The test, simple as it is,

requires the greatest care in its application, or for a certainty minute opacities will be overlooked.

ERRORS IN DIAGNOSIS.

There are certain errors in diagnosis which may be made, no matter what method of examination be adopted. In the direct examination the most common error is overlooking an opacity ; the most common error in the ophthalmoscopic examination is seeing an opacity which does not exist.

An opacity may be overlooked because it is not recognised, or it may be overlooked for the reason that it is hidden behind a contracted pupil. Fig. 4 will explain this ; only a small portion of the lens is

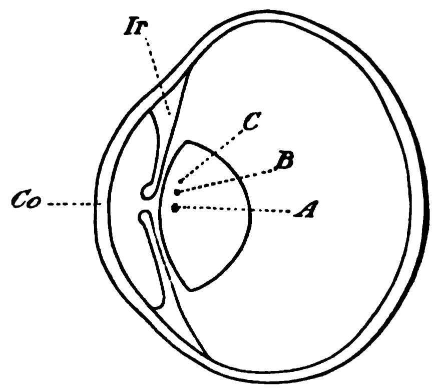

FIG. 4.—A VERTICAL FULL-SIZED SECTION THROUGH THE EYE OF THE HORSE.
Co Cornea, *Ir* Iris.

The pupil is shown contracted, but the corpora nigra are kept small and not allowed to touch, to prevent interference with the clearness of the diagram.

If the pupil be contracted, a cataract in the position A could only be seen if situated to the *right* or *left* of the centre of the lens, but neither cataracts B nor C could be seen.

Cataract B could be seen with a somewhat larger pupil, especially if situated to the right or left of the centre of the lens.

If the pupil be moderately dilated, cataract C can readily be detected.

seen through the pupil ; if the latter be narrow still less is seen, if moderately dilated much more may be seen, if completely dilated by repeated instillations of atropine the whole may be seen. If an opacity is situated towards the central and horizontal meridian of the lens it cannot escape detection when the pupil is moderately dilated, but a central opacity may and does escape recognition if the pupil be contracted, either because the iris covers it, or because it is entirely hidden by the corpora nigra.

The rule, therefore, never to pronounce a definite opinion on a lens when the pupil is narrow is absolute. A narrow pupil is one where the vertical diameter is not greater than one-eighth of an inch (3 mm.) A moderately dilated pupil is three-eighths of an inch (10 mm.) in a vertical direction. It is no use discussing the horizontal measurement of the pupil, firstly, because the pupil is a horizontal slit,

and secondly, because the dilatation of the pupil occurs through the contraction of the muscular fibres of the iris situated above and below the pupil, while the iris at either end of the pupil undergoes but little change in width, whether the pupil be dilated or contracted.

A contracted pupil occurs when the daylight used is too intense, or the sun's rays reach the eye. In such a case the corpora nigra block out the centre of the pupil, and may completely conceal a large central opacity. Assuming that the centre of the pupil is not blocked out, the contracted iris will cover such a considerable surface of the lens that disease may readily escape detection.

To dilate the pupils with atropine excepting in very special cases is not only impracticable but unnecessary, but fortunately two courses are open to us which will ensure sufficient dilatation of the pupil for all practical purposes.

When daylight, by means of a mirror, is thrown into the eye of a horse standing in a stable or under cover, the pupil does not contract to any considerable degree, sometimes not at all. To this rule I have met a few exceptions, but they are rare. When artificial light from a candle or lamp is thrown into the eye by means of a mirror, the pupil does not contract, or if it does it is to a very slight extent, for a large view of the lens may be obtained, and to this rule I know no exception.

The phenomenon then of practically a non-contraction of the pupil when the ophthalmoscopic mirror is used under the above conditions, is a very strong reason for employing this method of examining the lens, quite apart from the better definition obtained.

I have endeavoured to show that an error in diagnosis may occur through a pupil being too contracted to enable a proper examination to be made, but it may also occur through defective observation. A common one made by the beginner with the ophthalmoscope is mistaking the minute reflection of his mirror in the eye for a cataract; yet a moment's observation should prevent such an error occurring, for the reflection moves with the observer's head, and the sight-hole of the mirror may be seen as a minute dot. A much more pardonable error is taking streaks or bubbles of mucus on the cornea for striæ or spots on the lens, but as every time the eyelids close the streaks of mucus either change position or even disappear a little care will prevent the mistake. It is good practice in cases of doubt to rub the eyelids over the eye.

Finally, an error which perhaps can only be avoided by intelligent observation is one caused by specks of pigment from the corpora nigra being detached and adhering to the capsule of the lens. In the living eye the iris is practically in contact with the lens, and owing to the convexity of the latter the corpora nigra of the contracted pupil are absolutely in contact with it. Occasionally minute particles of these black bodies become detached, and remain adherent to the capsule, and when viewed with the ophthalmoscope they might readily be taken by the untrained observer for a cataract. A little care should however prevent this, for they come out as black specks on the lens, while a cataract is not a black speck but a dark one. But in cases of doubt oblique illumination will settle the question, for by this means the cataract or portion of pigment is seen in its natural colour, viz., white for the cataract, deep brown almost black, for the pigment.

GENERAL FEATURES OF CATARACT.

Cataracts in the horse may be diffused or local, single or multiple, viz., the whole lens, or only a spot on its surface a little larger than the point of a pin may be affected. It is certain that though some cataracts do spread over the entire area of the lens the majority do not, but remain throughout the life of the animal as spots or dots of opacity which neither increase nor decrease in size. For some years I watched a small cataract which had a clear centre and gave the impression of becoming absorbed, but such was not the case; the clear area never increased in size, and I think it may certainly be stated as a positive fact that a cataract never becomes absorbed.

Cataracts are more common towards the centre than towards the periphery of the lens. Bearing in mind the fact that as a rule cataracts showed no inclination to enlarge, and the probability that the bulk of them are hereditary, the important practical question arises to what extent and in what position does a cataract interfere with vision.

CATARACT NOT NECESSARILY A CAUSE OF IMPERFECT VISION.

If a cataract is seen on the periphery of the lens of a moderately dilated pupil, it is out of harm's way when the pupil is of its natural size; when a cataract is situated in the centre of a lens close to the surface it is entirely covered by the corpora nigra of a contracted pupil and can do no harm. If it occurs on the inner or outer half of the horizontal pupil, it may more reasonably be taken exception to on the ground of an interference with vision.

But, as a matter of fact, it is doubtful how far one spot of opacity in the visible portion of the lens of a contracted pupil does interfere with vision, and on this point we have the undoubted evidence furnished by the human subject.

This was forcibly brought home to me a year or two ago in writing on the function of the corpora nigra, bodies which are peculiar to the eye of the horse. I stated in a communication to the Royal Society,[1] that their position in the centre of the pupillary opening must cause a broken image of the picture to be projected on the retina when the pupil is contracted. Lord Rayleigh, speaking as a physicist, pointed out to me that this was not so, and that no interference with the completeness of the picture would occur.

To test this question I took an ordinary photographic camera representing an artificial eye, and accurately focussed on the back plate the image of a candle. A small piece of paper was now placed on the centre of the lens to represent an opacity, but it did not make the least difference to the sharpness of the picture, even when "stopped down" so as to represent a contracted pupil. It was not until the artificial pupil was reduced to the size of the opacity that the image of the flame became blurred.

I have had this question re-examined, Veterinary-Captain Butler kindly carrying out for me several experiments with artificial opacities on the photographic lens. He has found, as I did, that an opacity must equal in diameter the size of the artificial pupil before the image

[1] "The Refractive Character of the Eyes of Horses."—Proceedings of the Royal Society, vol. lv., 1894.

becomes "blurred," but in addition he has made the interesting observation that a faint opacity invariably "blurrs" an image, while a much larger and denser opacity has no effect. In other words a faint opacity is more destructive of a sharp clearly defined image than a dense opacity.

It appears clear that if a collection of bodies like the corpora nigra are not capable of interfering with the completeness and sharpness of the retinal image, a cataract the size of a dot situated at any point of the lens in the axis of vision need not give rise to serious apprehension about the sight; and, as a matter of fact, there are many horses possessing apparently undeniably good vision the subject of cataract, the condition only being discovered when the animal is examined for soundness on changing hands.

I do not, however, wish it to be inferred that I consider all cataracts negligible quantities; further, such an unsoundness must seriously influence the price of a high-class horse, and for an animal intended for breeding purposes may even render it useless.

In the present state of our knowledge I do not see how we are going to distingish between the opaque dots which are not going to extend and those which are; the balance of experience is that they will not extend, but in any case I am assuming they are congenital, which at present I believe the majority of cataracts to be.

SUMMARY.

In summarising the chief points in this communication I would direct attention to:—

1. The great value of the ophthalmoscope in the determination of cataract.

2. The necessity for examining the lens when the pupil is moderately dilated.

3. The concealment of cataracts by the iris and corpora nigra.

4. The fact that a dot of opacity even at the centre of the lens may be compatible with normal acuteness of vision.

5. That partial opacity in the form of dots is more common than general opacity, and that such dots if hereditary, as they probably are, show no disposition to spread or invade the entire substance of the lens.

6. Though cataract constitutes unsoundness it need not necessarily be a cause of rejection, but a purchaser should have the acuteness of vision guaranteed.

EDITORIAL ARTICLES.

THE DIAGNOSIS OF SWINE-FEVER.

DURING the first two years of its operations against swine-fever the Board of Agriculture was frequently subjected to unfavourable criticism with regard to its procedure in the matter of diagnosis. It was complained that the system followed left nothing to the skill and

judgment of the local veterinary inspector, and merely entrusted him with the mechanical work of eviscerating the suspected animal and forwarding its organs to the Laboratory of the Board. During the present year the ground for such complaints has been in large measure, if not entirely, removed, and it certainly cannot now be said that no responsibility is left with the local inspector. The present instructions direct that on arriving at the premises where the disease is reported to exist, the veterinary surgeon is to make general inquiry into the condition of all the pigs upon the premises, including their past history, and, in the event of his finding that any of them have died, he is to make a careful examination of the carcase throughout the whole of the intestinal and respiratory tract, with a view to discover the cause of death, and the nature of the lesions present.

If he does not find any of the typical lesions of swine-fever in the first carcase he examines, and if no other pig has died, he is to extend his inquiry to an examination of all the pigs on the premises. If after careful clinical observation he detects symptoms among them which lead him to suspect that swine-fever is present, he is to arrange with the owner as to the value of all the diseased or suspected animals, and he is authorised to slaughter one or more of them, if necessary, and continue to make *post-mortem* examinations until he is satisfied that swine-fever does, or does not, exist.

When conducting his inquiries into the condition and general health of the swine on the premises, the veterinary surgeon is to carefully examine any pigs which present an unthrifty condition, and as soon as he has established the fact that swine-fever exists, he is at once to slaughter all the other apparently diseased pigs on the premises, and arrange for the destruction of the carcases or their burial in some fit and suitable place at a sufficient depth and covered with lime.

In cases where in the opinion of the veterinary surgeon swine-fever exists, he is to forward with the least possible delay, addressed to the Chief Veterinary Officer of the Board of Agriculture, portions of the viscera in which the typical lesions are present.

In view of the greater responsibility which these instructions throw upon the veterinary surgeon in regard to the diagnosis of swine-fever, the present time seems opportune for considering the circumstances that ought to guide him to a decision in any suspected case. The instructions, it will be observed, direct the veterinary surgeon to take into account both clinical symptoms and *post-mortem* appearances, and it may therefore be worth while to consider here the relative value of these as a guide to diagnosis.

The symptoms usually exhibited in a moderately severe case of swine-fever are somewhat as follows. Slight but gradually increasing dulness and loss of appetite; the pig comes less readily than usual to be fed, and in the intervals between meals it does not move much about, but inclines to lie buried among its litter. A very early symp-

tom is drooping of the tail. As the disease advances the appetite for solids becomes almost lost, but thirst is present, and any liquid given with the food is greedily sucked up. Diarrhœa may or may not be present; when it is the fæces are generally greyish in colour, and unusually offensive in smell. The animal rapidly loses condition, and the coat becomes harsh and dry, and the hairs erect. Sometimes there is a little muco-purulent discharge from the conjunctiva. The respiration is not materially quickened, and the temperature may not be more than one or two degrees above the normal. In the last stage of the disease the pig lies persistently, and when made to move its gait is uncertain, and it may appear partially paralysed in its hind limbs. There may be some redness or lividity of the skin, particularly on the under surface of the body. Death occurs quietly and without convulsions.

If the disease is allowed to run a natural course the pig may exhibit most of the above symptoms for a week or two, and then gradually recover its appetite; but in young animals a long period of unthriftiness generally ensues, and growth is almost entirely arrested. The skin remains harsh and scurfy, and there is some degree of depilation, especially around the eyes.

In very acute cases, in which death occurs within two or three days after infection, the only symptoms exhibited are great depression, total refusal of food, profuse fetid diarrhœa, and pyrexia (up to 108° F.).

Last, but not least in point of importance, it remains to be said that in many cases of swine-fever the symptoms are almost *nil*. For a few days there may be slight dulness and drooping of the tail, but the appetite is retained, the temperature is scarcely above normal, and neither skin eruption nor diarrhœa is present. These statements are based on experiments in which pigs that had been fed with portions of ulcerated bowel and killed some weeks afterwards were found to have partially or completely cicatrised ulcers in the large intestine, although they had in the interval shown no decided symptoms of ill health.

There are some who maintain that the *intra vitam* diagnosis of swine-fever is not a matter of difficulty, but this confidence in their own skill is probably misplaced. When one has to deal with an outbreak or series of cases of swine-fever in which a reliable history of the pigs before and since the appearance of the disease is obtainable, then one may make a diagnosis with small risk of error, but when only one animal is ill, and its past history is not obtainable, then diagnosis is only a sort of guess-work with the chances of being right or wrong about equally divided; and in the case of a heterogeneous collection of pigs exposed in a market inspection with a view to the detection of swine-fever is a mere farce.

The points which are of most importance with regard to diagnosis during life are: (1) a record of exposure to infection, or of contact

with pigs whose history is not known (such as is involved in the purchase of pigs in open market or from a dealer); (2) evidence of the illness being contagious (several animals successively attacked in the same lot); and (3) the exhibition of a train of symptoms like those previously described. In other words, when in a lot of pigs that have been recently bought (within one or two weeks), or in contact with pigs recently bought, or otherwise placed in circumstances involving a clear possibility of infection, several are within a short interval attacked with illness, and exhibit such symptoms as those previously described, one may with little chance of error diagnose swine-fever.

It will be gathered from what has just been said that the detection of swine-fever during life is often difficult, and not infrequently impossible, but, fortunately, diagnosis is not attended with much risk of error when one has the opportunity to make a *post-mortem* examination before pronouncing an opinion. As the outcome of experiment and of observation on naturally occurring cases of swine-fever, it appears a justifiable conclusion that, with few exceptions, animals that become the subjects of this disease develop in the large intestine lesions that are pathognomonic. These lesions are either the diffuse diphtheritic inflammation (which is essentially a superficial necrosis), or the more frequently encountered circumscribed necrosis termed an ulcer.

It has been said that a diphtheritic enteritis may in the pig be caused by other irritants than the swine-fever bacillus, and it would be impossible to prove the contrary, but up to the present no evidence in support of that being the case in this country has been produced. In the present state of our knowledge one is therefore justified in pronouncing every case in which diphtheritic inflammation or the ulcers, described at p. 134, are encountered in the large intestine as one of swine-fever.

Does the absence of these lesions warrant the diagnosis—not swine-fever? The answer to this must be in the negative, for, from the cases described at an earlier part of this number (see Case I., p. 119), it is evident that a pig may die from swine-fever and yet present no lesion in the bowel beyond an intense inflammatory congestion and punctiform hæmorrhages. This may appear to constitute a serious objection to basing a negative diagnosis on the absence of ulceration or diphtheritic lesions in the large intestine, but in practice it has hardly any importance, for in naturally occurring cases of swine-fever (that is, excluding experimental cases infected with a very large quantity of material) death before the characteristic lesions have had time to develop in the bowel is probably an extremely rare occurrence. Consequently, although in any outbreak the first pig examined by the veterinary surgeon may not show characteristic lesions, this negative result of the *post-mortem* examination is very unlikely to be repeated in the next animal affected.

Finally, as a further qualification of the statement previously made regarding the diagnostic value of diphtheritic lesions and ulceration of the large intestine, it ought to be admitted that the bacillus of swine-fever probably sometimes propagates in the bowel or in the mesenteric glands without exciting any notable macroscopic alteration. This is suggested as a possibility by experiments in which, out of a number of pigs of the same age, simultaneously fed with infective material, some, when killed several weeks afterwards, were found to have numerous ulcers, others only a very few, and some none at all. But that would apply only to cases in which the disease runs such a mild course as to be unattended by any distinct symptoms, and the fact therefore ceases to have any important bearing on *post-mortem* diagnosis, since in practice this will nearly always be based on the autopsy of a pig that has died from the disease, or been killed while obviously ill from it.

THE DIAGNOSTIC VALUE OF SWELLING OF THE THROAT IN ANTHRAX.

A CASE which has recently been brought under our notice seems to show that some veterinary surgeons either credit the pig with immunity against anthrax or are not well acquainted with the symptoms usually exhibited by animals of that species suffering from the disease. The circumstances of the case were briefly as follows.

A sow that formed one of a lot of pigs kept in a grass paddock died somewhat suddenly on a Friday, and was buried without the cause of death having been ascertained. On the following day the remaining pigs were to all appearance in perfect health, but on Sunday morning two sows were found dead, and two others were obviously ill. During the course of that day all the pigs in the paddock (about twenty), with the exception of six young animals, were attacked, and in all of them the most prominent symptom was swelling in the region of the throat. During the following night another sow died, and the veterinary surgeon who was called in, after having made a *post-mortem* examination, came to the conclusion that the disease was anthrax.

It then came to light that on the previous Tuesday a heifer which had been enclosed in a shed broke down the barricade and was found in a dying condition. The person in charge thought that the heifer had somehow injured herself in breaking out of the shed, and he had her slaughtered. In dressing the carcase it was noticed that the flesh was rather dark in colour, and it was therefore considered unfit for use. The viscera, however, and other refuse from the dressing of the carcase, were thrown to the sows in the paddock. Some of the flesh was given to two ferrets and a cat, and all three animals died a day or two afterwards.

The owner, as soon as his veterinary surgeon had reported that the disease was anthrax, gave notice of the fact to the police, and in due course a visit was paid to the premises by the veterinary inspector to the Local Authority. And now comes the remarkable part of the case. The veterinary inspector, after he had seen the sows that were still ill, and inquired into the circumstances, "ridiculed the notion that the disease was anthrax, and thought that it was ordinary blood-poisoning!"

In these circumstances the perplexed owner sent the carcase of the next sow that died to the Research Laboratory of the Royal Veterinary College, and the *post-mortem* conducted there corroborated the opinion that had been given by the owner's veterinary surgeon. Although the carcase was semi-putrid, a cover-glass preparation made from one of the veins of the foot showed numerous anthrax bacilli, side by side with some putrefactive bacteria.

The clinical history of this outbreak is quite typical of the circumstances in which anthrax is met with in pigs, and it is therefore very surprising that the veterinary inspector of the district should have failed to recognise the true nature of the disease. To say that he failed to recognise the true nature of the disease is, perhaps, putting it too mildly, for it will be observed that he ridiculed the notion that the disease was anthrax, although that was the diagnosis made by his fellow practitioner. Swelling of the throat in the course of an attack of acute illness is in the pig almost pathognomonic of anthrax, and when in the case of pigs thus affected there is a history of their having recently been fed with raw flesh, the chances are a hundred to one that the disease is anthrax. It might, perhaps, be going too far to say that swelling of the throat and neck in the pig is by itself sufficient to warrant one in diagnosing anthrax, but it ought always to raise a suspicion of anthrax, and it makes it quite unjustifiable for anyone to pronounce the disease not anthrax unless he has fortified that diagnosis by microscopic examination or experiment.

In connection with swelling of the throat as a symptom of anthrax in the pig, reference may here be made to another outbreak, but in a different species, in which this was also a prominent feature of the disease. In this instance the animals attacked were calves from two to four months old, and the disease was remarkably fatal. The calves generally seemed quite well when fed in the evening, but next morning some of them would be found ill, the chief symptoms being refusal of all food, stiffness of gait, and swelling of the head and neck. This swelling was neither painful to the touch nor emphysematous, and it rapidly increased until death, which usually occurred within four to eight hours after the onset of the symptoms. In some cases the swelling about the head was so great that the eyes became invisible, while in others it was confined to the region of the throat and caused great dyspnœa. Nine calves in succession died with these symptoms,

and *post-mortem* examination revealed in them no marked evidence of disease elsewhere than about the head and neck. The swelling there was found to be due to a watery exudate, and some blood extravasations were also present in the same regions. The blood was coagulated in the heart and large vessels, and putrefactive changes set in rapidly in the carcase.

As the symptoms and lesions appeared to raise at least a suspicion of anthrax, the veterinary surgeon in whose practice the cases occurred (Mr J. Higginson, of Knockin) forwarded to us an ear and a foot for microscopic examination, and the blood from both sources was found to contain immense numbers of a small bacterium morphologically similar to the organism of fowl cholera. As this organism appeared to be present in a state of purity in such remote regions as the ear and the foot, it seemed probable that it was not an accidental or putrefactive bacterium. A rabbit was therefore, with the customary precautions, subcutaneously inoculated with a small quantity of the blood, of which a few drops were at the same time injected under the skin of the neck of a five-months-old calf. The rabbit died within twenty-four hours after inoculation, and its blood was found to swarm with a bacterium similar in size and form to that present in the blood of the calf. Pure cultures of this organism were obtained in bouillon and on agar. In the calf a painful swelling about as large as the hand spread out formed at the seat of inoculation, but the animal survived.

On a future occasion we hope to describe in detail the characters of this organism. Meanwhile the case is referred to here as an example of swelling of the throat not due to the anthrax bacillus, though doubtless many would call the disease anthracoid.

THE ANIMAL DISEASES BILL.

THE third reading of the Animal Diseases Bill has been carried by a large majority in the House of Commons, and there is not the least chance of the measure being thrown out in the House of Lords. In the future, therefore, or at least until the Act is repealed, the landing of cattle and sheep in Great Britain or Ireland, except for the purpose of immediate slaughter, will not be permitted. As is well known, that is the practice which has been in force in this country for a number of years, but it was at any time open to the Board of Agriculture to remove the restriction on the importation of store animals as soon as it appeared that such importation might be permitted without the risk of introducing disease. The present Act will therefore only make permanent restrictions that have been for some time in operation, but, from the vehemence with which the Bill has been opposed by some members of Parliament, it is plain that in several quarters a lively

hope was entertained that foreign store stock would, perhaps at no distant date, obtain free entry into this country.

The main reason publicly urged by those in favour of making the restrictions permanent has been that absolute security against the introduction of pleuro-pneumonia and other animal plagues does not exist as long as it is left to the discretion of whoever may happen to be President of the Board of Agriculture to remove or continue the prohibition of importation from any particular country. It is held that belief in the freedom of a State from disease might, when too late, be found to have been erroneous, and also that political considerations might, on some occasion, induce the Board of Agriculture to open our ports to foreign animals, although that involved some risk of the re-introduction of diseases from which our own cattle are now free.

The opponents of the measure, on the other hand, have denounced it as protection in disguise, as unnecessary for the exclusion of the diseases already stamped out of this country, and as seriously injurious to the interests of a considerable section of British Agriculturists. They have predicted that it will have the effect of raising the price of butcher meat to the consumer, and hinted that that is the real reason why it has found favour with the majority of land-owners and stock-breeders.

Prophecy cannot be met by argument, and time alone will show whether the exclusion of foreign store cattle and sheep will materially raise the price of beef and mutton in this country; but with free importation of fat cattle there does not seem to be any great cause for anxiety in this connection. In any case the consumer may take comfort from the thought that if that effect becomes apparent the Government of the day will probably be compelled to repeal the present Act.

CLINICAL ARTICLES.

SOME CLINICAL CANINE NOTES.

By F. Hobday, M.R.C.V.S., Royal Veterinary College, London.

A CASE OF PNEUMO-THORAX.

May 11th.—The patient, a fox terrier dog, between two and three years old, in good condition, when brought to the Clinique was suffering from an incised wound between the fore limbs. The history was that on the previous day the animal had jumped from a window and alighted upon some spiked palings. An examination revealed a wound in the skin which measured 3 inches in length, and a wound through the muscles of the thorax on the right side of the

sternum, slightly more than half an inch long. With each inspiration the lungs became inflated, and the apex of the right lung was plainly visible protruding between the costal cartilages. The parts were carefully cleansed, and the muscles drawn together with catgut sutures, the skin being afterwards treated in the same manner. Over this was placed a large pad of antiseptic wadding, the whole being bandaged as tightly as possible. The wadding was changed each day until the 26th, when there was only a small scar visible, and the patient was discharged as cured. A mild diet only was allowed for the first three or four days, the appetite being good throughout.

CEREBRAL HÆMORRHAGE; OPERATION.

The patient, a bull dog, two years old, in poor condition, was brought to the Clinique during the first week in May, the owner complaining of the animal's condition and irregular appetite. Thinking that perhaps worms might be the cause, a vermifuge was administered, but without having the desired effect. About ten days later the animal was brought back, the symptoms then being great dulness, disinclination to feed, lassitude, and a great desire to lie in any corner or dark place. The eyes had a peculiar dull, vacant stare, but the pupils were not dilated. When made to walk the animal did so very unwillingly and slowly, evidently with great effort. Sometimes the direction taken would be in a straight line, and sometimes in a semi-circular direction, usually from left to right, but occasionally the other way. It would walk into any obstacle that was in front, apparently without seeing it. No history of injury could be obtained, and the owner stated that the symptoms had come on gradually. For the next two days the dog was kept as quiet as possible, and treated with doses of pot. brom. Four days later a stage of semi-coma set in, all control of the limbs being lost. When placed on its legs the animal would walk one or two steps, and then fall in a heap. At this stage the owner's consent was obtained to an operation on the skull, the object being to try and find any clot which might be pressing on the brain. The dog was chloroformed and the skull trephined, but, as no clot was discovered, the animal was destroyed.

Post-mortem examination revealed the presence of hæmorrhage in the right lateral ventricle, and also a number of small hæmorrhages in the brain substance around and above this ventricle. The left side of the brain, and all the internal organs of the body, were apparently normal.

CASE OF FRACTURE.

26th May.—The patient, a fox terrier bitch, two months old, was brought to the Clinique on account of its peculiarities of gait. The owner stated that on the previous day the animal had jumped from a window ledge into the street, alighting on the fore legs, and then falling on to its head and chest, with the fore legs widely spread apart. Since then it had been unable to use them, and seemed to be suffering a good deal of pain. The symptoms now presented were as follows. When an attempt was made to persuade the animal to walk it sat upon the hind legs, with the fore legs straight out in front, the posture being very much like that of a kangaroo. When tired of this position it fell over, and could only rise with very great difficulty.

When made to walk its mode of progression was by a series of hops on the hind legs only, the fore legs simply dangling loose. Examination revealed the presence of swelling around each elbow joint, and a distinct crepitus accompanied by pain on manipulating the limb. The animal was destroyed, and a *post-mortem* examination revealed a fracture of the internal condyle of the humerus in each limb.

ACUTE LARYNGITIS; TRACHEOTOMY.

16th May.—The patient was a fox terrier dog, about three years old, brought to the Clinique in an almost asphyxiated condition. The owner said that the animal had commenced to breathe heavily on the 13th, and that it had gradually become worse, having lost all appetite. Examination revealed a large amount of swelling in the region of the larynx and down the trachea. Desiring to make sure that the dyspnœa was not due to any foreign body lodged in the œsophagus, a gag was placed in the animal's mouth, and a probang passed, but there was no obstruction manifest. After this the animal was secured on its back, and tracheotomy performed. By way of improvising an instrument to insert, a piece of hollow glass tubing was bent at the required angle, and maintained in position by a piece of tape tied round the dog's neck. The relief given was very great, the distressed breathing being much relieved. The tube was removed and cleansed twice daily, as during the intervals it became very dirty and clogged with mucus; and the region of the larynx was well fomented. The appetite and respirations improved, and on the 22nd the larynx was of normal size. On the 23rd the animal lost appetite, and respirations again became very much accelerated; on the 24th they were so much worse that the owner decided to have the dog destroyed.

Post-mortem revealed a catarrhal pneumonia involving the whole of the right lung.

A CASE OF TOOTHACHE IN A CAT.

May 1896.—The patient, a female cat, was brought by the owner on account of a peculiar habit of shaking its head at intervals, this being especially marked when attempting to eat solid food. The movements were all directed to the left side, and consisted of a series of peculiar shakes of the upper and lower jaws, the mouth being held open all the time.

Upon examination of the mouth it was found that the upper canine tooth on the left side had been broken off, and that the nerve was exposed; the lower canine on the same side was also broken off or else had been pulled out. Excessive pain was expressed when the site of the upper canine was touched, the effect being to immediately produce the peculiar jerky movements of the head which the owner had mentioned. The treatment adopted was to thoroughly cleanse the cavity and apply pure carbolic acid in order to destroy the exposed part of the nerve; no solid food was allowed for about five days. This treatment was repeated three or four times, and the symptoms gradually became modified, and at the end of ten days had disappeared altogether.

IMPERFORATE URETHRA.

The patient was a kitten, six weeks old, and was brought to the

Clinique, 17th February, on account of the above peculiarity, which had been noticed since birth.

Examination revealed the absence of a urethral orifice, the opening being apparently closed by a very thin skin, the exterior of which was moist owing to the presence of urine in the vagina. The urine appeared to slowly filter through this. The bladder could be distinctly felt through the abdominal wall and was much distended. An orifice was made with a lancet, and the urine escaped in quantity; the edges of the wound cauterised with argent. nit. to prevent them uniting again. The patient was seen again and made a good recovery.

ABDOMINAL SECTION AND EXCISION OF THE UTERUS.

CASE I. 23rd August 1895.—Fox terrier bitch, five or six months old, in poor condition, operated upon in order to prevent breeding.

CASE II. 11th February 1896.—Cat, eight weeks old, operated upon for the same reason as Case I.

CASE III. 17th February 1896.—Cat, two years, operated upon to prevent breeding.

CASE IV. 18th May 1896.—Cat, about two years old; a case of dystokia.

The method of operating in each case was the same; the animal was placed on its back on the operating table and anæsthetised. For the cats ether was used, and for the bitch chloroform. A flexible probe or catheter having been passed into the uterus, or as far up the vagina as possible, the abdominal wall on the left side of the mammæ was thoroughly cleansed with antiseptics and incised to the extent of about an inch or so. The forefinger or middle finger of the right hand was then passed into the abdominal cavity between the rectum and abdominal wall, searching for the probe, which was at the same time manipulated by the left hand. The left horn of the uterus was withdrawn and an aseptic catgut ligature passed above the ovary, the horn then being excised. The right horn was served in a similar manner. The body of the uterus was then ligatured just below the junction of the two cornua and the whole uterus removed, the stump being returned into the abdominal cavity. The abdominal muscles were drawn together with catgut, the skin being treated in a similar manner, and the whole being protected by a pad of antiseptic wadding and a bandage. After-treatment consisted in dressing the wound antiseptically and keeping the animal quiet on a laxative and restricted diet for four or five days.

In Cases I. and II., on account of the youth of the patients, it was not considered necessary to ligature before removing the ovaries and cornua, the parts simply being scraped.

Cases I., II., and III. did well; in each case it was necessary to remove one or two of the sutures in the skin as the wound suppurated a little.

In Case IV. the history was that the animal had had trouble with a previous parturition and had this time passed one kitten, a portion of a second having been seen.

Examination with the finger revealed the presence of something in the passage, but all efforts to reach it failed. The abdomen was opened, and the whole of the uterus and contents with both ovaries extirpated. The offending body proved to be the head of a very

large kitten. The abdominal muscles and skin were separately sutured, and the wound treated antiseptically with dry dressings. For the next four days the patient went on well, seemed lively and bright, and took a little milk ; but on the evening of the fourth day she became rather dull, and was found dead the next morning.

Post-mortem revealed septic peritonitis to be the cause of death.

EXCISION OF MAMMÆ.

CASE I. 20th August 1895.—Welsh terrier, five months old, suffering from severely contused mamma due to the animal having been run over by a cab.

CASE II. 21st August 1895.—Fox terrier, nine years old, suffering from abscesses in the mammæ.

CASE III. 26th August 1895.—Retriever, suffering from enormous enlargement of two of the mammæ, which had followed as the result of a kick. She was in great pain, and could scarcely walk ; when resting she was compelled either to sit up or to lie stretched out on the side.

CASE IV. 9th December 1895.—Irish terrier, about three years old, suffering from an induration and abscess of the mamma.

In all four cases the animals were anæsthetised with chloroform, and the offending parts carefully removed, hæmorrhage being arrested by means of ligatures or artery forceps, and the parts afterwards sutured, a space being left for a drainage tube. After-treatment consisted in the application of antiseptic dressings, and in each case a good recovery ensued.

In each of Cases I., II., and IV. one complete mamma was removed ; in Case III. two mammæ were involved and were excised, the mass removed weighing 2 lbs. 11½ ozs., and the wound requiring forty-three sutures to close it

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OBSERVATIONS ON GLANDERS AND MALLEIN.

By "OBSERVER."

WHEN any new remedy is recommended to be tried it is not uncommon to hear the phrase "if it does no good it can do no harm," used as an argument in favour of its adoption. Now, although it must be admitted that this style of reasoning is very often misleading, yet the logic of facts makes it clear that the remark is perfectly true as regards the use of mallein. If the mallein is sterilised, which it ought to be, and care is taken to disinfect the syringe and needle, no harm results from injecting it subcutaneously.

This is no haphazard opinion or hastily arrived at conclusion, but is based upon the experience of over 1500 experiments, in not one of which was there the slightest bad result ; no abscess formed at the point of injection, nor did any constitutional symptom result. In the face of this experience the washing of the skin of the neck over the seat of inoculation, which is by some foreign authors so much recommended, appears to be unnecessary.

While mallein produces a very marked effect upon glandered

horses its effect upon non-glandered animals, whether affected with any other disease or not, is practically *nil*. A few cases illustrating this may be mentioned.

CASE I. A horse, apparently healthy, with a temperature of 100·5° F., was injected with mallein on the Saturday night. Next morning the temperature was 105°, but otherwise he appeared all right. At the thirteenth, sixteenth, and twenty-fourth hours the thermometer registered the same high temperature. There was not the slightest swelling on the neck. Next morning he was found to have a swollen near hind leg and high temperature; he was, in fact, suffering from an attack of lymphingitis. The disease ran its usual course, and when again injected a fortnight later, neither local nor constitutional reaction ensued, thus proving the real character of the case.

CASE II. The animal was injected on Saturday night, temperature 101°, apparently healthy and well. Next morning the temperature was the same and there was no swelling on the neck. At the thirteenth hour the temperature was 104°, and the animal was off its feed; in the afternoon and evening temperature still high and appetite gone. No swelling on the neck, but the quickened pulse and the yellowish colour of the visible mucous membranes showed the nature of the illness—an attack of bilious fever. After its recovery this horse was again injected with mallein, but gave no reaction, either local or constitutional.

CASE III. The horse had a severe attack of spasmodic colic, twelve hours after injection. There was an increase of temperature about 3°, and also some swelling on the neck which did not subside for two or three days. A second injection with this horse gave negative results. The persistence of the swelling on the neck was considered to be due to injury when rolling about in pain.

A careful study of these cases is interesting and instructive from more than one point of view.

In each of them, and in many others which could be mentioned, the disease ran its usual course, neither aggravated nor cut short by the mallein. These cases also show the importance of having the local as well as the constitutional reaction.

The possibility of curing glanders by repeated doses of mallein has been discussed by some foreign authors. If this be possible it will prove a great triumph for medical science. A good deal can be said on both sides of the question. At present opinions should be given and received with great caution. The improvement seen in the condition of horses which have reacted to mallein proves at least that it has produced a beneficial effect, and favours the idea of ultimately curing. Another point which may be said in its favour is the fact that mallein detects the disease in its earliest stages, and thus places the patient in a most favourable position to recover. Putting out of the question animals which show visible signs of glanders, and dealing only with those that appear healthy but react to mallein, it seems only a fair inference to assume they are healthy or cured when they cease to react.

Having a bearing upon this point, the following experience is interesting. Two horses working together as a pair gave a typical reaction to mallein, and were isolated. During the following six months they received four injections of mallein. The last

time there was neither local nor general reaction. One of them was slaughtered and old-standing tubercles were found in the lungs. The other animal was kept for another twelve months and was then destroyed. Before its death a dose of mallein was injected and unexpectedly produced a good reaction, although the horse had been kept free from any fresh contagion. In this case also old-standing tubercles were found. Now both these horses might have been considered cured when mallein ceased to cause a reaction, but the subsequent test of one of them indicates that this failure to respond to the mallein was due to some temporary cause.

It would be important if we could ascertain the probable length of time that will elapse before clinical symptoms of glanders or farcy develop in horses that react to mallein. It is, of course, obvious that this will vary according to the surroundings and circumstances of each case, but we were hardly prepared for the long time our experience has demonstrated.

Nearly two years ago twenty horses were isolated because they had reacted to mallein. They still appear healthy, but when reinjected a very short time ago they all gave a good reaction, proving that they are still affected. Present appearances indicate that they are likely to become useless through their limbs becoming worn out before any signs of glanders or farcy appear. The apparently long time the disease slumbers has caused some horse-owners to express strong doubts as to the correctness of the action of mallein. This is scarcely to be wondered at. They see horses which science has marked as being affected with what has been so often described as a terribly dangerous and contagious disease fulfilling all the requirements of healthy animals for years without any evidence of this malady.

We know from old authors that under favourable circumstances horses would work for years even after some of the clinical symptoms had become developed. But little is known about this phase of the disease where the clinical symptoms are absent. That mallein which detects the disease also retards its progress appears a feasible theory.

Our old-fashioned ideas of the period of latency and the virulence of glanders have been very much upset by the use of mallein.

CLINICAL NOTES OF THREE INTERESTING CASES.

By WILLIAM M. SCOTT, M.R.C.V.S., Bridgewater.

STRANGLES IN THE HORSE, FOLLOWED BY PYÆMIA AND LATTERLY BY SEPTICÆMIA.

ANGINA, cynanche, adenitis, and pyogenic fever are a few of the more modern terms applied to that long-recognised and time-honoured equine disorder commonly known by lay and professional men under the everyday term of "Strangles."

Scientifically it is defined as a specific eruptive fever. When the disease runs its natural course, without any complications setting in, the case generally terminates favourably. But, unfortunately, some

patients are placed in adverse circumstances such as barometric and climatic alterations, bad hygienic surrounding, bad food, etc., in short, through the many vicissitudes of life itself, this benign disease is driven from its own course, forced to don the sombre and deadly mantle, and death then often claims our patients as its own.

The case of which I am about to give a detailed account, was in the early part of the year attacked with strangles. He was housed for a few days, and as all seemed to be going on well the owner decided to turn him out to the moor. Painful to relate, the horse had not been seen (practically) from that day to the day I was called in. On arrival I was informed the horse was with difficulty brought home. After careful examination I found the patient in a very prostrate condition. Pulse 78 perminute and very weak, breathing quiet, but breath charged with a sickly odour. Temperature 99·4°. Mucous membranes injected—dirty reddish-yellow, sphincter ani relaxed, and during each respiratory act air was alternately drawn in and expelled per rectum. The mouth musty, tongue furred, abdomen tucked up, limbs swollen, extremities cold. At the most prominent parts of the body the skin had become indurated and shrivelled (bed sores), the result of lying. Bowels and kidneys in action.

In the submaxillary space there was a fluctuating swelling the size of one's fist. That I lanced, and a sickly-smelling pus was liberated. Taking the previous history with the present symptoms above related, I had no hesitation in coming to an early diagnosis; in fact all the symptoms pointed to a most typical case of septicæmia following strangles. The following morning the patient was a little better, pulse beats stronger and not so frequent. Temperature still subnormal. The obnoxious odour which was emitted from the breath, and from the bowels in the form of flatus, had subsided to a remarkable degree.

The third day I had a wire to see patient early, as he seemed worse. I found him lying stretched out on his left side and breathing rather heavy. He would lie in this recumbent position for a few minutes, then get up and look back to his left side and occasionally touch his abdomen behind the last rib with his nose; at times he would droop his head and walk round the box, always, as far as my observation went, having the left side towards the centre of the box.

After great care he would lie down, roll over on to his left side, and lie stretched out. Fearing the pain would kill by exhaustion, I gave him a minimum dose of morphia subcutaneously, and left an anodyne composed of camphor and chloral hydrate to be given if pain returned. A stimulant was rubbed into the abdomen.

The following morning I saw him again and found him, as I thought, progressing favourably. The appetite slightly improved, but nothing solid was given save a handful of grass at times. On taking the temperature I found the sphincter more contracted than I had ever noticed it, and the swelling in the hind legs gradually passing off.

The next day found the patient much the same as previously; if anything, slightly better.

The following day I had another urgent message. Found all the untoward symptoms exaggerated. The bad odour had returned with all its unpleasantness. The breathing hurried and difficult. The eye

anxious and dim (this subject had only one eye), pupil dilated. The pulse numbered 90 per minute, weak and very irregular. On auscultating the chest over the region of the heart, that organ seemed to be tumbling about in a very disorderly manner, and I could distinctly hear (through the stethoscope) a sort of burring sound synchronous with the heart-beat. Dissolution was fast taking place. The same evening or early the following morning death had claimed him as its victim.

Treatment.—I have not considered it necessary to lengthen this article by giving a detailed account of the treatment. Suffice it therefore for me to say that I saturated the system with antizymotics — quinoidin and nitro-hydrocloric acid having considerable favour. The pain was counteracted by the drugs before mentioned. The nostrils steamed at the outset, the medium being medicated with turpentine. The surroundings carefully attended to as well as the general comfort of the patient. The atmosphere was saturated with creolin. As regards nutrients, milk and eggs, with Kepler's Cod Liver Oil and Malt Extract were lavishly utilised. The excretory organs were also attended to.

Post-mortem.—The following day I made a *post-mortem* examination. Rigor mortis only slight, the body rapidly decomposing. The double colon congested in patches, the small bowels healthy. The alimentary organs practically empty. The pyloric end of the stomach and 6 inches of the duodenum were the seat of discolouration, the hue being a pale yellowish-green with a tinge of blue in it. On cutting along the great curvature I left the discoloured part intact. The cuticular portion of the gastric membrane contained a number of bots, one-half of them being detached and lying dead in the fluids. On exposing the pyloric portion I found the remains of an abscess, the contents having been evacuated, and nothing remaining except a few threads of mucous membrane and a granulating irregular surface about 3 inches in diameter. The mucous membrane which I have already mentioned as lying across the ulcer was of a dark yellow colour tinged with brown. The duodenal mucous membrane presented an appearance identical with a piece of leather. The liver was soft and friable, and on cutting it a number of small abscesses were noted. The kidneys microscopically examined were found to be crammed with small emboli. The lungs, save for very marked hypostatic congestion, were healthy. The heart and pericardium outside seemed healthy. On exposing the cavities both sides of the heart contained an ante-mortem clot, each of which extended through the auricles right into their respective blood-vessels. The clot was fairly firm and of a pale reddish-yellow tinge.

Remarks.—Through the patient having been neglected and placed in adverse circumstances the strangles had become suppressed, and a metastatic abscess had formed in the coats of the stomach. Consequent upon that the animal became the subject of chronic gastric indigestion ; with all its symptoms of unthriftiness and poverty. This gastric abscess was in my opinion the first to develop, of a pyæmic origin. The liver and kidneys secondarily became diseased through metastasis, and the animal became in every sense of the term a "cracked pot." It is worthy of note that no metastatic abscesses were found in the lungs.

Owing to the disintegrated condition of the blood by organisms,

etc., combined with pulmonary congestion, an admirable opportunity was given for the formation of cardiac thrombi, which took place some fifteen hours before death.

When making this autopsy the thought struck me—what a mint of untold wealth is committed day and daily to the oblivious coppers of the knacker, what a fund of knowledge could be gathered if each and all the veterinary surgeons of this country kept careful notes of cases, and made autopsies whenever possible. It would bring us into closer relationship with the various and oft-perplexing symptoms made manifest during life, in comparison with those appearances presented after death. It behoves each one of us to do our level best to place this last superstructure of clinical medicine on a more scientific basis.

JUGULAR HÆMHORRHAGE CONSEQUENT UPON A PUNCTURED WOUND IN A HORSE.

On the 1st of May of this year I was requested to attend a half bred chestnut mare which had met with an accident in the neck, and was bleeding with great profusion.

Previous History.—Ten days previous to my attendance this animal had received a punctured wound in the neck, about 4 inches from the anterior extremity of the sternum and a little above the jugular furrow on the right side. This wound had been treated by one of those illiterate handy quacks who go about imposing upon the gullable public as well as the patients entrusted to their care.

Clinical History.—On my arrival I found the owner pressing the wound with a sponge to prevent the hæmorrhage, which when allowed its own course was very great. Constitutional examination showed the animal had lost a considerable amount of blood. The owner declared that she had bled over a stable bucketful. But taking into consideration the exaggerated estimate the lay mind is apt to form on looking at spilt blood, I should say the above-named quantity might be divided by two. On examination, the pulse at the submaxillary was very weak and small, the conjunctival mucous membranes very anæmic, and on the whole the animal pointed to considerable loss of blood. On taking note of the wound I found it situated, as previously mentioned, a little to the outside of the jugular furrow. On passing an exploring tube into the wound, while pressure was applied to the jugular further up the neck, I found it to extend 2½ inches in an inward, upward, and forward direction.

The calibre of the wound, as far as I could make out, would admit the entrance with ease of an extra-sized rectal dilating tube (Human). When pressure was applied to the vein above the bleeding practically stopped, when removed the hæmorrhage would commence with great volume, in a continuous stream and very dark in colour. Consequent upon bad treatment, and adding to the complexity of the case, the wound was very unhealthy.

Treatment.—The wound was thoroughly irrigated with an antiseptic (creolin); the hæmorrhage was checked by pressure upon the vein with a cork covered with lint and fitted into the jugular groove, this being kept in position by means of a strap tied round the neck, and fixed by taking advantage of the mane. The wound was plugged with carbolised lint, and the lips drawn together with two interrupted sutures. It was most interesting to note that if the

patient was given sloppy bran no harm resulted, but if given a mouthful of hay or grass a slight stream of blood would come through between the sutures. Consequently nothing but liquids and semi-solids were administered. Medicinally I prescribed sulphuric acid and quinine, three times a day. After about forty-eight hours I removed the plugging material, as the wound was manifestly septic. At the end of the wound a small clot of blood showed itself. The bleeding amounted to only about a half claret glassful.

I irrigated and replugged as before, and dusted the lips of the wound with iodiform. The pressure was removed from the vein.

The following day I had a wire to say the wound had burst out bleeding again. The patient had got her head down. All along I had had her tied up to a rack, and I attributed this as the cause of all the mischief. Redressed and plugged the wound.

I know it is bad surgery to pull about a wound if one desires the hæmorrhage to stop, but in this case I thought myself justified in so doing, considering that the wound was not altogether a septic. Furthermore, I took the precaution of guarding against a septic thrombus forming in the lumen of the vein by applying a hydrar. biniod. blister above and below the wound, and a few inches up the course of the furrow.

The following day the mare had slight fever, probably partly irritative, due to the blister; appetite fairly good, pulse stronger.

I plugged the wound twice more, and after that it seemed to be healing so well that I contented myself with having it syringed out three times a day with antiseptics. The vein was now felt to have become completely obliterated, the action of the blister having disappeared.

The next morning I was sent for, as the mare's neck had swollen all up the course of the vein to the angle of the jaw bone. This swelling was very hot, painful and slightly œdematous to the touch. The patient carried her head very stiffly. Continued hot fomentation was ordered, with a stimulating anodyne liniment to rub in. Lanced the swelling in several places to relieve the tension. A laxative was administered followed up with repeated doses of iodide and nitrate of potash. In three days time, after the acute symptoms had subsided, a blister was rubbed along the whole course of the neck.

Seven days after the application of the blister I saw the patient again, when I found a fluctuating swelling 2 inches above the site of the wound and in the furrow. That I lanced, and removed about 4 ounces of pus. With very little more treatment the patient was turned out to grass, and now bids fair to make a good recovery.

Remarks.—There is no doubt to my mind if the animal had been treated antiphlogistically at the outset, with proper care of the wound, the inflammatory action should have been kept in abeyance, and the consequent sloughing, which penetrated the coats of the jugular vein and caused the hæmorrhage, would never have occurred.

ASCITES CAUSED BY A FIBROMATOUS HEPATIC TUMOUR IN A DOG.

A few months ago an Irish terrier was sent to the infirmary for treatment, the abdomen having been noticed by the owner to become

seriously swollen and tense. The dog had not been well for quite two months previously. When first seen by me the abdominal wall was so tense and hard as to resist considerable pressure. The various diagnostic methods did not seem necessary to arrive at a pretty accurate conclusion, so that I directly made preparations to tap the abdomen. The seat of operation was a little to one side of the median raphe, and close to the umbilicus. The hair removed, the skin was disinfected with an antiseptic, a small incision made in the skin with lancet, and trochar and canula inserted. The fluid withdrawn was highly sanguineous, so much so, indeed, that the lumen of the tube at intervals became blocked with coagula. Care was taken not to allow all the fluid to drain away at once. At this, the first tapping, 3½ pints of fluid was removed. The patient had a bandage placed round the abdomen to give support. After collapse of the abdominal cavity one was in a better position to examine the various organs. I may here state the skin and mucous membranes presented an icteric appearance, the pulse was very weak, but the appetite fairly good. Distinct swelling was noted over the region of stomach and liver, but particularly on the right side. On pressing from below upwards behind the last ribs, the patient evinced symptoms of pain. The heart was examined as well as the lungs, but no evidence of organic disease was noticed. The cardiac sounds were weak. I gave it as my opinion that we had to deal with some obstructive liver disease, the nature of which I would not pretend to say. Treatment at this stage consisted in the administration of a small calomel pill followed up by doses of pot. iodide, but, considering the depressing influence these potassium salts have upon the cardiac and nervous systems, I deemed it good policy to give also some ammon. carb. and nux vom. Paracentesis abdominis was repeated in six day's time, the fluid having reaccumulated. The fluid was now not so sanguinous, but more of a straw-coloured hue. About 2 pints were removed at this tapping. The patient's appetite remained fairly satisfactory. The therapeutical agents previously mentioned were still persevered with, with the addition of dialysed iron. In the course of a few day's time the fluid was noticed to be increasing again. Seven days exactly from the time of last tapping, I performed the operation again. This time the fluid was not so clear as previously, and the quantity withdrawn was 2½ pints. Seeing the slow progress made by the patient, I consulted the owner as to the advisability of giving a lethal dose. To this he acquiesced, although with some reluctance.

Post-mortem.—On cutting open the abdominal cavity a quantity of fluid escaped. The parietal and visceral peritoneum, instead of being clear and glistening, was dull and opaque. Lymph and the other products of inflammation were conspicuous by their absence, and there were no adhesions except at a part in the small gut, where one fold of bowel was adherent to its fellow. The stomach healthy. The liver was found to weigh 19 oz., and was remarkably large in proportion to the size of the animal. The central lobe was the main seat of the disease, on section with the knife it cut like a piece of tendinous tissue, and practically the whole of the liver tissue had here been replaced by this new growth. One or two blood-vessels were noted on the surface of the section, their mouths standing widely open. The other lobes

were healthy outside the margin of the tumour. Pieces of the tumour were hardened in spirit, mounted in the usual way, and examined microscopically, which showed that the tumour was composed of fibrous tissue. The heart was healthy, but seemed loose and flabby. Kidneys soft and friable, apparently undergoing fatty changes.

SCLEROSTOMA ARMATUM IN THE SPERMATIC CORD.

By W. SELBORNE WORTHINGTON, M.R.C.V.S., Wigan.

WHILE castrating a grey two-year-old cart colt on 3rd June, I came across a specimen of the agamous form of the sclerostoma armatum in a rather uncommon position.

On the inner surface of the posterior or fibrous portion of the right spermatic cord, a little above the globus minor of the epididymis, was a tube composed apparently of white fibrous tissue, about three-sixteenths of an inch thick and one and an eighth inch long, situated immediately beneath the serous covering of the cord, and standing out distinctly above the surrounding level. The tube was disposed in an oblique direction downwards and backwards, terminating at its lower extremity about three-quarters of an inch above the globus minor. It was open at both ends and contained an agamous sclerostoma armatum of about the same length. The parasite was undergoing degenerative changes, being very soft and friable.

I sent the specimen to Professor Stockman who examined it, and identified it as the agamous form of the sclerostoma armatum. The colt, though in poor condition, is and has been apparently in good health, and the farm on which he has been reared has never been suspected of harbouring these parasites.

Abstracts and Reports.

MEAT POISONING.

IN the spring of the present year, in the Canton Thurgau, numerous persons fell ill after having partaken of pork that had been smoked. The flesh, it was alleged, came from animals that had been killed while seriously ill, the symptoms exhibited being redness of the skin and gastro-intestinal catarrh. Seven persons who had partaken of this flesh were during the following day attacked with gastro-intestinal catarrh, and one child, aged four years, died after two days, with profuse diarrhœa and cramp-like contractions.

No symptoms of disturbance were produced in animals fed with the flesh in question, but, on the contrary, the intraperitoneal injection of cultures obtained from the discharges of one of the patients and from the flesh were always fatal. In the discharges from the patients and in the suspected flesh there was present a short motile bacillus with rounded ends. The case

affords fresh proof that salting and smoking do not suffice to destroy pathgenic bacteria.—*Zeitschrift für Fleisch und Milch Hygiene.*

CONGENITAL IMMUNITY IN SHEEP-POX.

In the course of his experiments on sheep-pox Duclert found animals that presented an absolute or relative immunity, these were the progeny of mothers that had suffered from an attack of sheep-pox before conception. He then undertook experiments to prove the heredity of immunity in this disease. For this purpose he used as control animals lambs of three or four months' old, born of mothers not vaccinated against sheep-pox, and he compared the result with that obtained in the case of lambs of the same age born of mothers possessed of immunity. All were inoculated by hypodermic injection, and while the control animals succumbed to sheep-pox the others showed an absolute or relative immunity. Where the immunity was relative the disease developed, but the animals survived. In a small outbreak of sheep-pox among six months' old lambs which were the progeny of ewes that had acquired immunity by a previous attack, the affection remained benign, but still the disease was more severe in lambs of three or four months than in others of the same age that had been inoculated experimentally. Congenital immunity thus appears to be transient in sheep-pox.—*Revue Vétérinaire.*

VACCINATION AND RETROVACCINATION.

Vaccination was introduced into the Dutch East Indies eight years after its discovery by Jenner, and since that time the government of the island has taken the greatest care in the propagation of the vaccin. Nevertheless the culture from arm to arm has in many occasions been interrupted in one district or another, and it has then been necessary to wait for a new importation from another district or from Holland. Frequently, on account of the distance, the vaccin sent from Holland has given only mediocre results or failed altogether.

On that account attempts were made to cultivate the vaccin in calves or cows, but strange to say this did not succeed until 1884, in which year Dr Kool succeeded in inoculating a heifer with vaccin taken from an infant. This retrovaccin gave very good results, and in 1890 an institute was founded at Batavia for the culture of calf-vaccin.

Some authorities draw a distinction between this retrovaccin and cow-pox lymph, and assert that the former does not confer the same degree of protection as the latter. The following experiments by Eilerts de Haan are interesting as bearing on that point, and still more interesting from their bearing on the question of the identity of small-pox and cow-pox :—

First Series —A small area of skin on the back of a monkey was shaved, then washed with water, and after that with a solution of salicylic and boracic acids; finally it was dried, and five punctures were made on it with freshly collected retrovaccin from a calf. Four days afterwards papules formed at the seat of vaccination, and evolved in the ordinary fashion. This experiment repeated on six other monkeys always gave the same result. The monkey is thus susceptible to the retrovaccin

Second Series.—These seven monkeys were inoculated again with fresh retrovaccin after the crusts had fallen. Result negative. Monkeys infected with the retrovaccin are thus immunised against the retrovaccin.

Third Series.—Using the same precautions as in the first series, a monkey was inoculated with the contents of pustules from a case of small-pox in the human subject; seven days afterwards excavated papules surrounded by an areola had formed, and there were also some papules on the lips and extremities. This generalisation was produced only once in seven such experiments, but in every one of the monkeys inoculated some pustules formed. The monkey may thus be infected with small-pox of the human subject, and this variolation as a rule gives rise to only a local eruption.

Fourth Series.—A monkey was inoculated with the contents of one of the pustules of a monkey of the first series. This second passage gave good pustules after seven days, and the same result up to the seventh passage.

Fifth Series.—The monkeys of the fourth series were inoculated with fresh retrovaccin after the crusts had fallen. Result negative. The retrovaccin cultivated by successive passages in the monkey retained its infective power and its immunising power.

Sixth Series.—The seven monkeys of the second series and the six monkeys of the fifth series were inoculated with the contents of pustules from a case of smallpox. Result negative. Retrovaccin from the calf as well as retrovaccin cultivated by seven passages on the monkey thus preserves the monkey against small-pox.

Seventh Series.—The small-pox of the first monkey of the third series was inoculated on a second monkey, and one obtained only pustules localised at the point of inoculation. The third, fourth, fifth, sixth, and seventh passages gave similar pustules, always in seven days. This series of experiments was repeated thrice with the same results.

Eighth Series.—With the sixth passage of the seventh series a calf was inoculated; after five days this calf showed pustules which in all respects resembled those ordinarily obtained with calf-vaccin. This experiment has been repeated with the same result with the seventh passage of the seventh series.

Ninth Series.—The second calf of the eighth series was inoculated seven days after the first inoculation with fresh retrovaccin. No result.

From these experiments one may draw the important conclusion that the retrovaccin protects the organism of the monkey against the virus of small-pox; this fact is in favour of the identity of the retrovaccin with the ordinary vaccin, which produces the same effect.

The author remarks that at the present time we know nothing about the origin of cow-pox or of the relationship between that and small-pox, but he inclines to the view that true cow-pox, mitigated small-pox, and retrovaccin are identical; for each of these three viruses: (1) Provokes in the human subject after seven days similar pustules, with more or less fever; (2) protects against small-pox; (3) changes the duration of development when one inoculates it to various species of animals; and (4) degenerates after a greater or smaller number of passages on animals of the same species.

The author admits that the most convincing proof of the identity of small-pox and cow-pox would have been furnished by using matter from the mitigated small-pox of the monkey for vaccinating human beings; that, however, was an experiment that he did not feel justified in performing.—*Annales de l'Institut Pasteur.*

ANTITOXIC SERUM IN THE TREATMENT OF ANTHRAX.

In the month of January 1887, in the first number of the *Annales de l'Institut Pasteur*, Metchnikoff stated that cultures of the anthrax bacillus made in the blood of vaccinated sheep had lost their virulence to such a

degree that a cubic centimetre of the culture was incapable of causing the death of a rabbit. This fact raised the question whether the bacilli had been attenuated by contact with the serum, or whether the serum rendered the animal insusceptible to anthrax. The discovery of the preventive property of the serum of immunised animals has again raised this problem, and Marchoux has devised and carried out a series of experiments to show whether the serum of animals that have been immunised against living and very virulent anthrax cultures is preventive and curative.

His experiments were carried out partly on rabbits and partly on sheep. When experiments have to be carried out on a large scale it is much better to immunise animals of the latter species, as they furnish much more blood. The sheep were first vaccinated according to the method of Pasteur, and they then had injected under the skin progressively increasing doses of virulent anthrax cultures; the quantity was doubled every eight days, and ultimately a dose of 200 cc. or even 300 cc. of a very active culture were injected at one time. With such enormous doses the animals exhibited a very marked reaction, manifested by diminution in weight and an elevation of temperature which sometimes lasted for eight days. When the culture was injected into the veins the effect was scarcely more severe than after subcutaneous inoculation, provided only a small quantity of virus was used, but the intravenous inoculations were much more dangerous when large doses were employed.

A sheep vaccinated in the ordinary way is quite refractory to inoculation with anthrax, even when large doses are employed, but the serum which such an animal furnishes has scarcely any preventive properties and no curative power at all. In order to develop the latter it is necessary to bring about a very high degree of immunity, so that the animals will bear the enormous doses which it is necessary to inject from time to time.

As regards the proper moment at which to bleed an animal in order to obtain the most efficacious serum, it was ascertained by experiment that the curative power of the serum is most marked at from fifteen days to three weeks after the injection of virulent cultures.

The first sheep was bled on the 18th January, and its serum when tested was found to have no preventive power. Two rabbits, one of which received 12 cc. and the other 20 cc. died after the same lapse of time as the control animal. The sheep was bled again on the 28th May 1895; it had been under treatment since 18th January, when it received about 200 cc. of culture, and the last inoculation had taken place on the 18th May with 100 cc. On the 29th May three rabbits were inoculated, the first with 2 cc. of serum, the second with 4 cc., and the third with 8 cc.; on the following day each of them received at the same time as a control animal one-third of a cubic centimetre of virulent anthrax culture. The control animal died in twenty-four hours, and rabbit No. 1 in eighteen days, while rabbits Nos. 2 and 3 survived. This experiment was repeated on several occasions, and always with most identical results. With a dose of 3 cc. the life of the animal was always saved and several times this result was obtained with 2 cc.; on the other hand, a dose of 1 cc. never sufficed to protect.

The second sheep, after it had received 1050 cc. of virulent anthrax culture, furnished a serum which was only a little stronger than that of the first sheep. The dose which certainly protected had been reduced to 2 cc.; and sometimes 1 cc. was preventive. When this second sheep had received a total of 1400 cc. of virulent culture the preventive power of its serum had risen to such a degree that $\frac{1}{4}$ cc. was preventive. This is the most active serum that Marchoux has been able to obtain, but he thinks that it might be obtained of a higher degree of activity by using in place of sheep larger and more sensitive animals, such as the ass or the horse.

The experiments just described show that the serum of the sheep is possessed of distinctly preventive powers against anthrax; but none of the animals treated by this serum had been vaccinated; all succumbed to a subsequent inoculation with virulent anthrax.

In these experiments the inoculation was made under the skin of the flank, and the serum was injected on the one side and the anthrax on the other. It was found that the inoculation was more or less grave according to the point of the body where it was made, and in order to obtain protection a larger or smaller dose of serum was necessary according to the seat of the inoculation. Thus, in order to preserve a rabbit inoculated under the skin of the ear required twice as much serum as when the inoculation was made under the skin of the back.

A certain number of experiments were made on guinea-pigs with the serum, but in no instance was a successful result obtained. Ten cc. of serum injected into the peritoneum delayed death twelve hours after that of the control animals, and this was the best result obtained in the case of guinea-pigs.

Experiments were also made to test the curative power of the serum. It was ascertained that the injection of a sufficient dose of serum immediately after inoculation with the virus sufficed to prevent development of any symptoms of the disease, just as if the bacilli introduced under the skin had not been able to develop. These animals were not vaccinated, for when subsequently inoculated they died from anthrax at the same time as the control subjects. The result is not the same when an interval is allowed to elapse between inoculation with the virus and the injection of the serum; in the case where the serum was injected into rabbits in from seven to twenty-four hours after infection, the animals showed premonitory symptoms of the disease, and when the animals were subsequently tested twelve days afterwards it was found that they had acquired a very solid resistance to anthrax. When there is already considerable œdema at the seat of inoculation before the serum is injected it is very difficult to save the animal's life, even when considerable doses are employed; the best result obtained in such a case was the survival of a day or so after the control subjects. It was noted, however, in the case of some of the animals that twelve or eighteen hours after the administration of the serum there was a distinct diminution in the extent of the local œdema or even a complete disappearance of it; nevertheless, these animals died with numerous bacilli in the blood, but Marchoux thinks that the result holds out hope that by obtaining a more active serum it may be possible to save the animal's life even at this period of the disease.

The immunity acquired by vaccination does not at all resemble that which is brought about by antitoxic serum; the one is profound and lasting, the other superficial and transient. Vaccinated animals can support enormous doses of virulent cultures; thus, a rabbit vaccinated a year previously, and which had not for eight months received any inoculations, resisted inoculation with a dose of 5 cc. of culture, and this, although the previous inoculations had never exceeded 1 cc. of virulent culture at a time. These facts throw into strong relief the difference between the immunity, difficult to acquire but very durable, which is conferred by vaccination with anthrax virus, and the almost immediately acquired but temporary immunity which follows the injection of anticarbon serum.—*Annales de l'Institut Pasteur.*

THE NATURE OF TRANSLUCENT AND CALCAREO-FIBROUS NODULES IN THE LUNG OF THE HORSE.

In a recent volume of the *Archiv für Wissenschaftliche und Praktische Thierheilkunde*, Dr Olt has published an article on the above subject.

As long as the author was not acquainted with the youngest developmental stages of the nodules he examined the older firm more or less calcified nodules, and he was able to corroborate the descriptions given by Csokor and Kitt, according to whom these lesions are of embolic origin. In the case of almost all the calcified nodules evidence could be obtained that they stood in connection with a blood-vessel, and in the younger nodules, Olt was able to make out that the wall of an interlobular vein merged into the capsule of the nodule. Subsequently Olt had the opportunity to examine such nodules in the primary stage of their development in a horse's liver. The nodules or tubercles were in this case as large as a hempseed; they showed a pale greyish-yellow colour, and were connected with the liver tissue, but they could be shelled out with the point of a knife. The tubercles were calcified, but at the same time they were easily crushed between two slides. In the interior of the nodules Olt was able to make out a young echinococcus.

The more or less firm and frequently calcified tubercles which are often encountered in the horse's lung are, according to Olt, ascribable to different causes. Some of them are emboli in the sense of Csoker and Kitt; in some of them Olt was able to make out the presence of echinococci, but as a rule they contained another parasite, namely a species of nematode. Olt reports that Grips of Hamburg had made a similar discovery in the case of these embolic nodules, and in two fresh nodules of the lung some of the anatomical characters of the parasite could still be made out. Changes in the muscular tissue and in the intestinal tube indicated that the parasites were dead larvæ, probably belonging to the *sclerostoma armatum* and it is suggested that these had probably been carried into the lung in the blood of the vena cava.

Calcareo-fibrous tubercles are also frequently found in the bronchial glands, they closely resemble the lung and liver tubercles, and in their case also Olt was able to make out their embolic nature. In Stettin as many as 70 per cent. of the horses slaughtered had calcareo-fibrous tubercles. The horses were of various ages.

According to Olt, there is no difficulty in distinguishing between these calcareo-fibrous nodules and glanders tubercles. With regard to the differential diagnosis, he says that in the liver the glanders tubercles are always embolic in their origin, and they are preceded by a lesion of the skin or of the respiratory apparatus. Hence, if glanders lesions are not present in some of the other organs the tubercles in the liver must be pronounced not glanderous; calcareous nodules in the liver are distinguished by having all the same appearance and the same age, whereas in glanders of the liver the tubercles are obviously of different ages. A further distinction is afforded by the fact that glanders tubercles acquire a pale yellow softened centre, whereas the tubercles or nodules caused by animal parasites never soften centrally, but undergo dry necrosis and calcification. The calcification of glanders tubercles has been altogether denied by distinguished authorities. In many cases one finds all the nodules caused by animal parasites, both in the lung and the liver calcified; in the case of glanders, however, young tubercles are always present.

Calcareo-fibrous tubercles in the horse's lung have been held to represent primary lesions of pulmonary glanders. In the year 1882 Schütz examined 127 lungs taken from horses that were alleged to have suffered from primary

pulmonary glanders, but the result of the examination gave no support to the belief that even in a single case the primary lesions had been in the lung. Nocard has asserted that when horses that have reacted to mallein subsequently cease to react it may be concluded that the disease has healed up, and that at the *post-mortem* of such animals the proof that they have suffered from glanders will be found in the presence of translucent tubercles in the lungs. In criticism of this statement of Nocard's, Olt points out that Nocard had not proved that these translucent tubercles were glanderous lesions either by inoculation experiments or by bacteriological examination, and he believes that the translucent tubercles which Nocard found had been formed around animal parasites.

In 1894 Schütz pointed out that grey translucent calcified tubercles were frequently found in the lungs of the horse, and, although they are sometimes found in animals that have been the subjects of glanders, Schütz could not admit that they are really glanderous in their nature. In a more recent article Schütz adheres to this view, on the ground of the negative result of inoculation experiments made with such tubercles. After the discovery of the glanders bacillus Schütz renewed his examination of these tubercles, but in an examination of hundreds of specimens made by himself or his assistants he was never able to prove the presence of glanders bacilli, either by microscopic examination or by cultivation. Many inoculation experiments with guinea-pigs were also made with such tubercles, and in all cases the result was negative.

Quite recently (February 1896), at a meeting of the Central Veterinary Medical Society held in Paris, Nocard returned to the subject of translucent tubercles of the horse's lung, and reaffirmed his former conclusion that such tubercles are glanderous in their nature. Nocard thus describes the characters of the glanders tubercle:—

The glanders tubercle presents itself in the form of a nodule which may vary in size from a hempseed to a small pea; when one runs the hand over the surface of a glandered lung the tubercles are felt like pellets of shot either underneath the pleura or in the depth of the sound lung tissue. The appearance of the tubercles varies with their age; at first the tubercle appears as a small round spot, yellowish, greyish, or pale red in colour; it is semi-translucent, may be easily crushed, and is homogeneous throughout, showing neither central softening nor peripheral condensation. On microscopic examination such a tubercle is found to be simply a collection of leucocytes, which through their behaviour towards staining reagents are evidently vitally active. A little later, one observes in the centre of the tubercle a small, opaque white point, which marks the death and caseation of the cells there. This dark point gradually increases in size, undergoes softening, and becomes surrounded by a thickened ring of condensed fibrous tissue.

When the lung of a horse that has been the subject of chronic glanders is examined, one always finds in it tubercles of the above type. When all the horses in a stable in which a case of glanders has occurred are subjected to the mallein test, it very often happens that a number of apparently sound horses do not show the characteristic reaction, but when these animals are killed one finds in their lungs a variable number of miliary tubercles, many of which have the translucent appearance which represents the first stage of development of the tubercle. In some of these horses one finds that only this form of tubercle is present. Analogous tubercles may be found in horses that have not reacted to mallein, if the stable from which they come has been for a long time infected. When a guinea-pig or an ass is inoculated with one of these translucent tubercles, even when that is taken from the lung of a horse that was clinically glandered, the inoculation usually fails, and, in the same

way, attempts to cultivate the glanders bacillus from translucent tubercles has also generally a negative result.

This failure to transmit the disease by inoculation with translucent tubercles, or to cultivate the glanders bacillus from them, although they are in reality glanders lesions, Nocard explains as follows :—The tubercle retains its translucent character as long as the cells which have accumulated round the bacilli retain their vitality, and the cells do that only so long as they are able to overcome the bacillus. Hence the tubercle may retain its primitive appearance for a long time, and then gradually undergo a fibrous transformation and eventually disappear. But if in the struggle between the glanders bacilli and the animal cells that have accumulated around them, the victory lies with the former, then the cells in immediate contact with the bacilli die and undergo caseation. In this way arises the white, central, opaque point of the tubercle.

When Nocard endeavoured to produce translucent tubercles experimentally by subcutaneous intravenous, or intratracheal injection, or by introducing pulverised material into the trachea, he succeeded in infecting the animals with glanders, but the pathological lesions did not take the form of miliary tubercles, but where analogous to the lesions which are found in the ass after the injection of glanderous material, namely, more or less extensive infarcts, circumscribed areas of pneumonia, or a glanderous broncho-pneumonia. In one case, however, Nocard found these translucent tubercles in a mule that had been infected by way of the alimentary canal, virulent glanders culture having been administered in a piece of carrot.

Nocard has more recently repeated these experiments on eighteen horses, an ass, and a mule. In all these animals the infective material was administered mixed with the food or water, and in all of them the experiment gave the same result. The lungs showed a variable number of glanderous lesions in the shape of tubercles as large as a millet seed, some of them being caseous and soft, others completely translucent, and still others commencing to caseate. That the translucent tubercles had been in existence in the experimental animals prior to the administration of the infective material was negatived by the fact that no such lesion was found in the lungs of control animals set apart in the experiment. Six of the experimental horses had been taken from a regiment in which no case of glanders had been known for ten years, and none of the animals had reacted to mallein. Four of the horses to which the glanders culture had been given mixed with water had, fifty hours afterwards, a sudden rise of temperature, varying from 1·8° to 2·6° C., and six days later an injection of mallein provoked such a severe reaction that it was feared the animals would die, while the mallein injection had no effect on two control horses. After eight days four of the experimental horses showed swelling of the lymphatic glands, and one of them also had nasal discharge and ulceration. Fifteen days after the infection two of the experimental horses and one control horse were killed. In the two experimental animals the lungs were studded with a large number of miliary tubercles in all stages of development, some of them being uniformly translucent; on the other hand, the lungs of the control animal contained no tubercles.

In another experiment the result was the same. In this case virulent glanders culture mixed with water was administered to a horse; this had the effect of setting up severe symptoms of glanders, and after thirteen days the horse was killed. At the *post-mortem* tubercles in all stages of development were found in the lungs. Potato cultures made from these caseous tubercles all yielded colonies of the glanders bacillus, and three guinea-pigs, into the peritoneum of which material taken from three caseous tubercles had been injected, all became glanderous. A large number of tubes were also inoculated from twenty translucent tubercles of this lung, but in spite of the large

quantity of material employed only seven colonies of glanders bacilli grew. From these experiments Nocard draws the following conclusions:—

First. Glanders is easily transmitted by way of the alimentary canal.

Second. The translucent tubercle is a glanderous lesion and represents the first stage of the classical tubercle.

Third. The translucent tubercles are less rich in bacilli than the caseous tubercles, and the bacilli which they contain become very quickly destroyed by the cells.—*Deutsche Thierærztliche Wochenschrift.*

EQUINE TUBERCULOSIS.

At a recent meeting of the Central Veterinary Society, in Paris, Professor Nocard contributed an interesting note on the subject of tuberculosis of the horse. He recalled the fact that for a long time it was believed that the horse was refractory to tuberculosis. It is now known, however, that the horse may become tuberculous, and during the last fifteen years many cases have been recorded in which the diagnosis has been made certain by the discovery of the specific bacillus. The number of published observations at the present time are probably not much short of a hundred, but at the same time one may say that equine tuberculosis is still rather rare.

Strange to say, all the known cases have been isolated ones, even when the subject attacked has been one of a large number in the same stable. Two explanations of this peculiarity might be offered. In the first place, a tuberculous horse soon becomes incapable of active service, and he is therefore slaughtered at an early stage of the disease in order to avoid useless expense. In the second place, the lesions are in most cases localised to the digestive organs; the lungs are only invaded at a late stage, and the animal is almost always slaughtered before the pulmonary lesions have had time to undergo the softening which would render them dangerous for the companion animals in the same stable.

The published observations regarding tuberculosis of the horse are very dissimilar, but one may divide the cases into two very distinct types. In the first type, which seems to be much more frequent, the infection seems to have taken place by way of the alimentary canal; the mesenteric and sublumbar lymphatic glands are hypertrophied, indurated, or softened; the spleen is enormously enlarged and filled with voluminous humours of variable consistence; the intestinal mucous membrane is often studded with ulcerations, localised especially on Peyer's patches or the closed follicles. When the lungs are invaded the lesions are manifestly recent, and consist in a diffuse infiltration of the interlobular connective-tissue, without apparent tubercles, caverns, or centres of softening. It is that which explains both the absence of cough, discharge or expectoration, and the non-transmission of the disease to other horses in the same stable.

In all the cases of this type which Nocard has observed (numbering, since the year 1878, fourteen) he has always observed, in advanced stages of the disease, a very abundant polyuria lasting several weeks, and in eight of the cases he was able to make a clinical diagnosis from the general state of the subject, the polyuria, and the discovery on rectal exploration of an enormous hypertrophy of the sublumbar glands.

From the bacteriological point of view, this abdominal form of tuberculosis of the horse is characterised by an extreme abundance of Koch's bacilli in the lesions, and by the great length of these bacilli.

In the second type of the disease the tuberculosis seems to have had its starting-point in the lungs; at least these organs and the bronchial glands are the most severely affected. The aspect of the pulmonary lesions is very

variable. Sometimes it is a case of true acute miliary tuberculosis; sometimes the parenchyma of the lungs is studded with small abscesses with a fibrous capsule, enclosing pus that is very rich in bacilli. Sometimes one might believe that it was a case of a neoplasm of a sarcomatous character generalised in the lungs. A case of this nature was brought before the Central Society by M. Humbert in 1887. On section these tumours are homogeneous, white, firm, and without central softening or a fibrous envelope at their periphery. On *a priori* grounds nothing would lead one to suspect that the lesion was tuberculous, and it is only by microscopic examination that one is able to recognise the nature of the lesion. This shows that the lesions are made up of tuberculous follicles, very rich in giant cells, but very poor in Koch's bacilli.

Both these forms of tuberculosis of the horse are inoculable, and in the guinea-pig and the rabbit inoculation provokes the development of characteristic lesions. Nevertheless, on several occasions Nocard had occasion to observe that in the guinea-pig while the lesions are manifestly tuberculous, they differ a little from those which are observed after inoculation of tuberculous products taken from the human subject or the ox. While the lymphatic glands were hypertrophied and softened, and there existed an exudation into the peritoneum and pleura, the spleen was healthy or slightly hypertrophied and softened, but without apparent tuberculous lesions.

For a long time Nocard did not attach any importance to these different results of inoculation of tuberculous materials from the horse, but he now thinks that he can offer an explanation of them.

In 1891 Nocard presented to the Congress for the study of tuberculosis some cultures of tubercle bacilli taken from the horse and from the pig. These cultures had absolutely the same aspect as cultures of human origin, and they behaved in an identical way with regard to different media, or culture in different subjects of experiment. These types of tubercle bacilli have been carefully preserved since then, and they have always retained the same characters. They are employed indifferently for the production of the tuberculin utilised in France since 1891.

Nocard obtained the culture of equine origin by directly inoculating tubes of glycerinised serum with caseous pus taken pure from the large encysted nodules of the lung of a horse seized the same morning at the slaughter-house. The animal seized was in very good condition, and prior to slaughter there was nothing to lead one to suspect the existence of such lesions as were found in the lungs. The pus used to inoculate the tubes was very rich in Koch's bacilli. Strange to say, two of the fifteen tubes thus inoculated gave at the outset abundant vigorous cultures. Ordinarily it is necessary to pass the disease through the guinea-pig or the rabbit in order to obtain cultures, and in most cases one does not succeed until after several transmissions. In the case of the pig it is only after a seventeenth passage through the rabbit that Nocard has succeeded in obtaining his first culture. The bacilli had acquired a virulence so great that the rabbit succumbed to a veritable tuberculous septicæmia in fifteen to eighteen days after intravenous inoculation.

This first culture of equine origin, which was completely similar to cultures of human origin, came from a case of tuberculosis localised in the lung.

Lately Nocard had occasion to study specimens taken from two horses attacked with the abdominal form of tuberculosis. The clinical signs and the autopsy reproduced exactly the state of things previously described with reference to this type of the disease, namely, progressive emaciation, extreme feebleness, intense polyuria, considerable hypertrophy of the spleen and mesenteric glands, and the pulp of the glands extremely rich in bacilli of great length.

Nocard seized the occasion to attempt to infect some guinea-pigs and rabbits and to inoculate a large number of glycerinised potatoes, which he

covered with a thick layer of gland juice. On this occasion again he was fortunate enough to obtain at the very outset a culture in one of the tubes inoculated; this culture was vigorous and abundant, and it was used to obtain many new cultures on various media.

These new cultures had, unexpectedly, all the characters of cultures of the bacillus of avian tuberculosis. In place of being dry, verrucose, difficult to dissociate like the cultures of the human bacillus, they were thick, soft, fatty, and easy to spread on any medium.

On the other hand, the manner in which the bacilli comported themselves with regard to the various experimental animals indicated that this germ was much more closely approached to the avian bacillus than to the human one. That is shown in the following experiment.

On the 11th March, with a slightly diluted third culture, he inoculated:—

First.—A guinea-pig weighing 440 grammes under the skin of the thigh.

Second.—By intravenous injection a Russian rabbit weighing 1450 grammes, a common rabbit weighing 1760 grammes, and a fowl weighing 1630 grammes.

The Russian rabbit died on the 31st March, at which time it weighed 1175 grammes: the second rabbit died on the 6th April, and then weighed 1370 grammes; while the fowl died on the 9th April, and then weighed 870 grammes. In these two rabbits the lungs were infiltrated with incredible numbers of greyish or transparent extremely small granulations. The spleen was double the normal volume; it was deep red in colour, smooth, and of soft consistence, and its pulp was a veritable pure culture of bacilli. In the fowl only the spleen appeared to be affected; it had acquired the size of the thumb; it was soft, and its pulp was, as in the case of the rabbits, a veritable pure culture of bacilli. The liver was pretty firm and of normal volume, but the examination of a preparation made from a scraping of it showed Koch's bacilli in notable numbers.

On the 9th April the guinea-pig, which had always remained lively and vigorous, weighed 485 grammes. At the seat of inoculation there was a small ulcerating wound, and the lymphatic glands of the flank were hypertrophied and indurated.

The two guinea-pigs inoculated on the 5th January with a little spleen pulp from the first horse died on the 19th and 27th March with an ulcer at the point of inoculation, generalised tuberculosis of the lymphatic glands, exudation into the pleura, and a large, red, soft, smooth spleen, without any apparent lesion, although the pulp was very rich in bacilli.

It is well known that ordinarily fowls resist inoculation with human bacilli, and that, on the other hand, guinea-pigs are very resistant to the bacillus of avian tuberculosis. This latter is also the case with the new type of bacillus that Nocard has experimented with from the horse.

Nocard admits that the lesions provoked by this equine bacillus are not absolutely identical with those caused by the avian bacillus, but he suggests that that may be due to modifications impressed upon the bacillus from the fact of its having been acclimatised in the organism of the horse. In any case he considers it certain that the bacillus obtained from the abdominal type of tuberculosis of the horse approaches much more closely to the bacillus of avian tuberculosis than to the bacillus of equine tuberculosis.

On clinical and pathological grounds Nocard had drawn a distinction between the two great types of tuberculosis of the horse, and he now claims that this distinction has been confirmed by the determination of the causal agent, for, while the pulmonary form is referable to human tuberculosis, the abdominal form appears to be the same avian tuberculosis.

This observation is interesting in still another direction. It shows that although there are mammalia which offer a marked resistance to the avian bacillus (such as guinea-pigs and dogs), there are others which may even in

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natural conditions contract tuberculosis of avian origin and succumb to it ; but if that is true for the horse and the rabbit, who dare affirm that it may not be the case for man also?

Nocard asserts that this is not merely a hypothesis, for he studied some years ago tuberculous sputum which was rapidly fatal by inoculation to the rabbit, but rarely killed the guinea-pig, although it provoked in the latter species lesions identical with, or very analogous to, those due to the avian bacillus. He also obtained cultures of the bacillus of this origin by inoculating media with splenic pulp from rabbits dead after intravenous inoculation. These cultures were absolutely identical with those of the avian bacillus. However, the majority of the fowls inoculated with these cultures resisted, whether the inoculation was made under the skin, into the peritoneum, or into the veins. Those which died presented at the *post-mortem* lesions similar to those of the natural malady. In this case again the sojourn of the bacillus in the human organism seemed to have profoundly modified its virulence.

Nocard points out that if, as appears probable, the human subject may contract tuberculosis from the fowl, the most elementary prudence requires that the sale of fowls coming from a place in which the disease exists ought to be interdicted, for the consumption of a tuberculous fowl in the roasted condition involves a risk of the ingestion of a considerable number of living and virulent bacilli.—*Recueil de Méd. Vét.*

REPORT OF THE DEPARTMENTAL COMMITTEE ON SWINE-FEVER.[1]

THIS Committee was appointed on the 29th January 1895 :—

(*a*) To review the experience gained since the Act of 1895 came into operation, respecting the etiology, pathology, and morbid anatomy of the diseases classed as swine-fever.

(*b*) To supplement that experience by a series of experiments as to the bacteriology and life history of these diseases, and as to their communication, either directly or indirectly, from animal to animal.

(*c*) To bring together the results of the work of foreign investigators.

The members of the Committee were Professor Brown, Mr A. C. Cope, Mr M. Hedley, and Professor M'Fadyean, with Mr Leopold Hudson as secretary.

In reviewing the experience gained since 1893, the present Report recalls the fact that the Swine-Fever Act was passed in accordance with the recommendation of the Departmental Committee which was appointed 7th February 1893, to inquire into the working of the provisions of the Contagious Diseases (Animals) Act, in so far as they related to swine-fever, and, having regard to the nature of that disease and to the conditions under which swine are affected therewith, to consider whether any more effective measures could be adopted for its prevention and extirpation.

That Committee examined twenty-seven witnesses—veterinarians, inspectors, farmers, dealers, and members of local authorities. They also had before them resolutions and memorials forwarded to the Board by various local authorities and other bodies.

In their Report the Departmental Committee of 1893, after commenting on the remarkable uniformity of opinion on the part of the witnesses with

1 Report of the Departmental Committee appointed by the Board of Agriculture to inquire into the Etiology, Pathology, and Morbid Anatomy of Swine-Fever. Eyre & Spottiswoode: 1896.

regard to the desirability of legislation, advised that the work of exterminating swine-fever should be placed in the hands of a central authority, and recommended that the Board of Agriculture should obtain the necessary powers for the purpose.

Accordingly, a Bill was introduced into Parliament to confer on the Board power to slaughter and to pay compensation. This measure was passed, and on 1st November 1893, the Swine-Fever Act, 56 & 57 Vict. c. 43, came into operation.

A general Order was passed revoking existing regulations and substituting new ones. An explanatory circular was prepared, and sent to all local authorities, additional travelling inspectors were appointed, and the system of slaughtering diseased swine, as well as those which had been in contact with them or in any way exposed to infection, was actively pursued under the direction of the Board.

A year's experience sufficed to show that the system pursued by the Board did not make any permanent impression on the disease, which was, according to the published returns, more prevalent at the end of 1894 that it was when the Swine-Fever Act came into operation at the latter part of 1893. Under these circumstances, the present Committee was appointed to review the experience gained since 1893, and to supplement the review by an experimental inquiry in order to strengthen the scientific basis upon which the operations against swine-fever are founded, and upon the completeness and accuracy of which the success of those operations will to a large extent depend.

With this object in view, the Committee directed that experiments should be conducted bearing on the etiology, pathology, and morbid anatomy of swine-fever, and also instituted a series of observations on the clinical aspects of the disease.

In accordance with the instruction referring to the work of foreign investigators on the subject of swine-fever, the Committee have consulted all the available literature, and have been in correspondence with some of the chief experts who have devoted themselves to the study of the contagious fevers of the pig.

In regard to the etiology of swine-fever, the Committee state their belief that there is no room for the slightest doubt that the sole cause of the disease is the introduction into the animal system of the specific organism derived from a previous case of the disease.

Swine-fever does not, and cannot arise under any conditions which exclude the specific virus; in order words, it is not a sporadic disease, but one of the true contagia, being in this respect in the same category as small-pox, cattle-plague, and other contagious diseases of man and animals.

The Committee define swine-fever as a contagious and infectious disease of the pig associated with a necrotic and ulcerative condition of the mucous membrane of the intestine, the morbid condition being nearly always most marked in the large intestine.

The disease of the lungs which occasionally accompanies the disease in the intestine is either collapse or pneumonia. It is necessary, however, to observe that in none of the experiments performed for the Committee was pneumonia produced either by inoculation with pure cultivations of the micro-organism, or by feeding with the natural material obtained from animals suffering from swine-fever.

In very acute cases of swine-fever the disease may prove fatal within two or three days, and then the only lesions present may be intense inflammation of the stomach or intestines or of both; and in these exceptional instances a certain diagnosis cannot be made except by bacteriological methods. But it would appear, from the experimental evidence, that whenever a pig survives for more than a few days after infection, a careful examination immediately

after death will disclose, in connection with the alimentary canal, lesions that are so distinctive of this disease as to warrant a positive diagnosis.

The investigations which have been made do not lead to the conclusion that there has been any marked alteration in the general character of swine-fever during recent years, but, as compared with the intensely virulent type of the disease when it was first recognised in this country, it appears to have undergone a certain amount of amelioration. It is still, however, observed that the acute and rapidly progressive form of the disease is commonly met with. There are also, and always have been, many cases of the obscure or chronic form of the disease, in which the morbid changes go on slowly for many weeks or months, and finally attain an excessive state of development, without being attended by any of the symptoms which are usually accepted as diagnostic of swine-fever.

Some very important information in regard to the obscure form of swine-fever was obtained by the Committee from the examination of swine which had been isolated for a period of two months on infected premises. At the end of that time they had been certified by a veterinary surgeon to be free from swine-fever, and would in the ordinary course have been released. In several of the instances, instead of being released, the swine were, at the request of the Committee, slaughtered and the organs sent for examination. In each set of specimens characteristic lesions of swine-fever were detected.

The clinical history of a number of cases of the chronic form of swine-fever is found in an appendix. In this inquiry observations on the progress of the disease were continued for several months, and experiments were made to test its infectivity. It was found that animals placed in contact with the diseased swine, or in the sties which had been occupied by them, became affected with a similar type of slowly progressive disease. On *post-mortem* examination of all the original cases the remarkable feature was the great disproportion between the very advanced lesions in the digestive canal and the slight symptoms of disease exhibited by the animals during life.

An important question arose as to the probability of swine affected with the obscure form of the disease being sent to large slaughter-houses and bacon factories for slaughter. This apprehension was set at rest by the inquiry which the Committee directed to be made in different parts of the kingdom. For this work veterinary surgeons were selected on account of their experience and knowledge of swine-fever, and they were instructed to forward, for the inspection of the Committee, all specimens in which they found indications of swine-fever.

In the course of their inquiry, altogether 13,783 specimens were examined, and in none of the specimens forwarded were any swine-fever lesions detected. Indeed, taking into account the fact that in nearly all cases of chronic disease the animals, although not exhibiting any characteristic signs of swine-fever, are in poor condition and totally unfit for the butcher, it is not probable that they would be sent for slaughter. There is still, however, ground for suspecting that they may be sent to markets and sales as store pigs, and it is a well-known fact that a very large number of outbreaks have been traced to swine recently purchased at public sales.

The experimental investigations on the morbid anatomy of swine-fever were directed chiefly to the recognition of the less pronounced lesions of the disease. The Committee were already aware that the well-known and easily-detected lesions, *i.e.*, the so-called button ulcers, diphtheritis, and necrosis of the intestinal membrane were commonly absent in the early stage. It was the more important, therefore, to ascertain the minimum amount of *post-mortem* evidence which could be safely accepted as proof of the existence of the malady.

The Committee are satisfied that too much importance has been attached

to a condition of plugging of the crypts on the ileo-cæcal valve and on Peyer's patch at the end of the ileum, a condition which is extremely common in adult pigs. In order to determine whether this condition should be accepted as an indication of swine-fever, twelve pigs were fed with plugged valves obtained from apparently healthy swine, and the experimental animals were subsequently slaughtered and found to be quite healthy.

In connection with the morbid anatomy of swine-fever reference is made in the report to bacteriological investigations and experiments which were carried on for the Committee by Professor M'Fadyean, who was able to cultivate from the organs of pigs that died or were killed while suffering from swine-fever a bacillus which the Committee regard as the cause of the disease. This bacillus has been cultivated in artificial media through many generations, and experiments have shown that such cultivations are capable of affecting pigs with swine-fever. The bacillus which is the cause of swine-fever is not sharply distinguished by its form, size, or staining reactions from many other organisms (harmless and pathogenic): hence it cannot, like the germs of anthrax or tuberculosis, be identified by microscopic examination. On the other hand, the bacillus of swine-fever may, without difficulty, be cultivated by ordinary laboratory methods from the fresh organs of a pig dead of the disease, and cultures thus obtained can be distinguished by their mode of growth from those of any other known organism.

In reviewing their work for the year the Committee find that the following facts have been established:—

(1) Bacteriological investigations prove that the cause of swine-fever is a specific microbe.

(2) Experience and observation prove that swine-fever (both in its acute and chronic forms) is communicable from diseased to healthy swine by contact, and also by the agency of persons, animals, and substances which are capable of conveying the infective matter.

(3) It has been shown that the pronounced symptoms which have hitherto been looked upon as essential to a correct diagnosis are not always present in the early stage of swine-fever, and are almost constantly absent in the chronic form of disease.

(4) The Committee regard it as an important outcome of the study of the morbid anatomy of the disease that some animals undoubtedly infected with swine-fever, presented only minute erosions in the intestinal canal, and that other animals, which had been suffering from either the acute or the chronic form of the malady, but which had recovered, showed only depressed scars which were apt to be overlooked at any but a very thorough *post-mortem* inspection.

(5) From the experimental evidence it is concluded that a condition of mechanical plugging of the crypts on the ileo-cæcal valve cannot be accepted as an indication of swine-fever.

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MEDIAN NEURECTOMY.

By FREDERICK HOBDAY, M.R.C.V.S., Royal Veterinary College, London.

THIS operation, which has not yet become generally adopted in England, has been practised for some time by veterinary surgeons in Germany, France, and Belgium. According to M. Pellerin, a Paris veterinary surgeon, who has written a small pamphlet on the subject, Median Neurectomy was first practised by Peters of the Berlin School several years ago, he himself (M. Pellerin) having been the first to introduce it into France in 1892.

The operation consists in the excision of a portion of the median nerve high up on the inside of the elbow-joint, just below the internal condyle of the humerus; in this latter situation the nerve runs behind the artery, then crosses it, and descends in a slightly forward direction behind the ridge formed by the radius, to pass deeply down between this bone and the flexor metacarpi internus. Before operating the animal should be cast and chloroformed, the usual antiseptic precautions being observed; a cross-hobble is then applied, and the leg, released from the other hobbles, is pulled downwards with a rope in order to expose the surface to be operated upon, and render it as tense as possible. A bold incision is then made through the skin and aponeurotic portion of the pectoralis transversus and panniculus muscles, about 1 to 3 inches (depending on the size of the horse) below the internal condyle of the humerus, and immediately behind the ridge formed by the radius; this latter, and the nerve which can be felt when passing over the elbow-joint, form the chief landmarks. The hæmorrhage which ensues is principally venous, and is easily checked by artery forceps. In some cases I have found it of advantage to put

on a tourniquet below the seat of operation, but this is not always advisable, as it distends the radial artery. We now have exposed to view the glistening white fascia of the arm, which must be incised cautiously for about an inch; this will reveal the median nerve itself, situated upon the red fibres of the flexor metacarpi internus muscle. If not fortunate enough to have cut immediately over the nerve, it can be readily felt with the finger between the belly of the flexor muscle and the radius. The next step is to raise the nerve by passing a tenaculum behind the muscle, taking care to avoid injuring the artery or vein, and excise as much as possible. After this the wound is sutured and treated with antiseptics, etc., until it has healed, plenty of cold water being applied, and a fair amount of exercise allowed.

The following is a list of cases upon which the operation has been performed:—

CASE 1 was an aged pony, suffering from an overshot fetlock, on the off fore leg, due to severely contracted tendon; it was very lame, in fact could scarcely bear any weight upon the limb when walking, and trotted with the greatest difficulty; various remedies were tried for two months, but all without any temporary or permanent benefit.

On 5th October 1895, median neurectomy was performed under chloroform; the result was wonderful; when sufficiently recovered from the chloroform the animal both walked and trotted without manifesting the least lameness. The wound was treated antiseptically until it healed; on the 12th of October the pony walked stiff and sore from the wound, but after trotting for some distance this worked off, and the lameness was scarcely perceptible. However, as the fetlock became more overshot, and the animal gradually became as lame as before the operation, it was destroyed on the 6th November. Careful dissection of the limb (for which I am indebted to Mr Sykes of Class B) revealed the skin to be firmly adherent to the subcutaneous tissues at the point of operation, the portion of the media nerve above the wound to be of normal size, whilst that below was somewhat atrophied, though not to such an extent as to interfere with its dissection. The primary cause of the trouble was found to be a small ulceration of the articular surface on the internal side of the lower end of the large metacarpal bone; there was also an exostosis on the antero-internal aspect of the joint.

Remarks.—This animal was operated upon under the impression that the enormously thickened tendon was causing lameness by pressing upon the plantar nerves during the act of locomotion; it certainly gave temporary relief, and, had not the ulcerated spot been present, might have sent the animal back to walking work. Of course the proper shape would not have been restored to the legs, nor would lameness have been removed if due to mechanical interference.

CASE 2.—Cab mare, very lame, suffering from indurated wind galls, with exostoses on the fetlock and down the inside of the metacarpas. She had been fired three months before, and various remedies tried without success, being still very lame. Median neurectomy was performed under chloroform on the 16th October 1895. After the operation there was a decided improvement, although there was still slight lameness. This latter may perhaps be accounted for by the fact of my having made a much larger wound than I ought to have done, and

also having pricked the vein. The mare was sent home, antiseptics and plenty of cold water applied, and exercise allowed freely.

25th October. Slightly stiff, otherwise lameness scarcely perceptible.

11th November. Wound quite healed; animal sent to work. I have seen the mare since, and received word from the owner a few days ago; she is working regularly, and has been doing so ever since; there is no apparent difference either in action or any other way between this leg and the other.

CASE 3.—Cab mare, aged, very lame, suffering from exostoses at the back of the fetlock and down the inside of the metacarpal bone. Median neurectomy was performed under chloroform 29th October 1895; owing to the fact that it was almost dead at the completion of the operation, the animal was not trotted. The wound granulated rather too freely, and had to be cauterised several times, finally healing up at the end of November. The mare was sent to work early in December, and has been regularly working ever since.

CASE 4.—Was a high-stepping pony, six years old, very lame from a large splint and a chain of smaller exostoses on the inside of the metacarpal bones. Actual cautery and subsequent blistering had been applied without success or any amelioration in the lameness. Median neurectomy was performed under chloroform 16th November 1895. When trotted after the operation there was not the slightest lameness perceptible; the wound progressed favourably, and the animal was sent to work 16th December. I saw the pony again this year on the 12th of August, and could detect no difference whatever between the action of the two legs. The animal has been in regular work ever since the operation, and has not shown the slightest sign of lameness. The smaller splints had disappeared, and the larger one was certainly only about one-half its former size. This process of absorption, however, is well known to sometimes occur in the case of splints, and without further statistics can hardly be put down to the operation.

CASE 5.—Pony, eight or nine years old, very lame on the near fore leg, suffering from an exostosis on the antero-internal region of the fetlock joint. The joint could be flexed well, so that the lameness did not appear to be due to mechanical interference.

Median neurectomy was performed under chloroform 17th January 1896. It was too dark when the pony recovered from the chloroform to notice the gait.

7th February. The wound was healing well, there being no lameness whatever; on the 11th the animal was discharged as cured, with instructions to go to work in about ten days. Unfortunately, a few days after this the pony met with an accident, from the result of which it became a cripple and was destroyed.

CASE 6.—Cab gelding, very lame on the near fore leg, suffering from exostoses on the antero-internal region of the fetlock. It had been in the present owner's possession four months, and had been lame about a month.

Median neurectomy was practised under chloroform 27th January 1896; after the animal had recovered from the chloroform it was too dark to see the immediate effect. This horse was put to work eleven days later, and worked regularly until April, when an attack of colic terminated its existence.

CASE 7.—Chestnut pony gelding, fifteen or sixteen years old, very lame in the near fore leg; suffering from a large exostosis immediately under the carpal bones on the internal aspect of the joint. The limb could be flexed fairly well. Thinking that lameness was possibly due to pressure of this exostosis on the upper portion of the internal plantar or other structures supplied by the median nerve, median neurectomy was performed under chloroform. As there was no improvement immediately after the operation, nor after the lapse of a month, the owner sold the animal, and I was unable to trace it further.

Remarks.—The diagnosis may have been incorrect, but possibly also there was some hidden affection in the carpal joint connected with the exostosis.

CASE 8.—Cab mare, about nine years old; been very lame for eight weeks, suffering from a large exostosis immediately under the postero-internal aspect of knee, which did not appear to interfere with flexion at all. This had been fired by pyro-puncture five weeks previously and afterwards blistered, no improvement resulting.

Median neurectomy was performed under chloroform on the 3rd of February. When trotted immediately after the operation the mare was decidedly less lame; by the 20th the lameness had almost entirely disappeared, and the animal was sent to work the following week.

I saw this patient a few weeks ago; she had been working regularly ever since, and showed no sign of lameness; the owner had noticed no point of difference between this leg and the other, and the action was not in any way altered; the exostosis appeared to be just about the same size as before the operation.

CASE 9.—Cab mare, aged, had been very lame for the past three months; had been in present owner's possession for eighteen months. The animal was suffering from exostoses on the inside of the fetlock and knee, and also had contracted and thickened tendons as the result of an old sprain. Actual cautery had been applied eight weeks before with no beneficial result.

Median neurectomy was performed under chloroform on the 5th of February. After the operation there was a decided improvement, and on the 17th the lameness was scarcely perceptible, whilst on 2nd March there was none at all. This animal was set to work a week after this latter date, and has been in regular work ever since. I saw her a few weeks ago and could detect no lameness or any difference between the action of the two legs.

CASE 10.—Cab gelding, seven years old, very lame, suffering from old-standing sprain and thickening of the flexor tendons, ringbone, and large splint. Had been fired on each place at some time or other; had been in present owner's possession six weeks, been lame three weeks.

11th February 1896.—Median neurectomy under chloroform; after the operation there was a very slight improvement.

2nd March. Only slightly lame; wound going on well. This animal was sent to work a few weeks later, and worked with occasional fits of lameness for about ten weeks, when the owner turned it out to grass; eventually it was sold, and I have been unable to trace it further.

CASE 11.—Cab gelding, nine or ten years old, very lame, suffering

from old-standing sprained tendon and ringbone. Had been fired and blistered five weeks before with slightly beneficial effect.

Median neurectomy under chloroform was performed 29th February 1896. After the operation the animal was certainly improved, though still slightly lame; this all disappeared at the beginning of April, and the horse was sent to work. I saw the patient a few weeks ago at work; the owner said that it had worked regularly ever since, except for a week's rest with slight sprain which was treated successively with cold applications.

CASE 12.—Cart mare, six years old, excessively lame, suffering from a splint as big as a tangerine orange and from ringbone. Had been lame for twelve months; was fired and blistered nine months ago, and turned out to pasture for eight weeks; worked well for a week, then fell lame again.

16th March 1896.—Median neurectomy was performed under chloroform. When trotted immediately after the operation the animal was still very lame, but in a few minutes this all passed off, and no lameness was perceptible. She was sent to work early in April, and in a communication I lately received from the owner I am informed that there has been no sign of lameness since, and she is in regular work.

CASE 13.—Van gelding, aged, excessively lame from the presence of a large splint; had been so about a fortnight.

18th March 1896. Median neurectomy under chloroform; immediately after the operation the animal trotted lame, but in a few moments this decreased and ultimately passed off altogether.

Sent to work early in April and is at present working regularly, the owner stating that there has been no lameness since.

CASE 14.—Van gelding, aged, been in the present owner's possession three or four years; had worked at intervals only for the past six or eight months; would work for a few days and then fall lame; was now lame both fore. Suffering from old-standing sprained and thickened tendons of both fore legs; had been fired twice, the last time being four weeks ago, with no improvement.

2nd April 1896. Median neurectomy of both fore legs under chloroform; no lameness could be detected after the operations; was sent to work the first week in May; has been working regularly ever since and shows no sign of lameness.

CASE 15.—Pony gelding, very old, had been in owner's possession six or seven years, had been very lame three months; suffering from old-standing sprained and thickened tendons, ringbone, and a very tender chain of splints.

2nd April 1896.—Median neurectomy under chloroform; immediately after operation lameness could scarcely be perceived; sent to work early in May; saw animal a few weeks ago, no sign of lameness, and owner said had been working regularly ever since.

CASE 16.—Cab mare, aged, suffering from a large splint on each fore leg, ringbones, and thickened tendons; had been fired some weeks before; was very lame on the near fore, and owner said was constantly lame on the off; had been lame at intervals for some months.

20th April. Median neurectomy was performed with the aid of cocaine by Mr Pierce, College Tutor; after the operation there was a

great improvement, although there was still perceptible lameness on the near fore. This eventually passed off, and the animal was sent to work on the 19th of May; has been at regular work ever since, with one interval of a few days' rest owing to the animal having hit her fetlock with the shoe of the other foot.

CASE 17.—Pony, aged, been in owner's possession six months, been very lame for six weeks; suffering from navicular disease.

21st April 1896. Median neurectomy with the aid of cocaine; no lameness after the operation. This animal was sent to work when the wound healed, but I have been unable to trace it further.

CASE 18.—Cab mare, aged, was lame when bought by present owner five days before; very lame, very tender and sore over region of a splint situated underneath the perforans tendons in the lower third of the bone.

25th April 1896. Median neurectomy under chloroform. Slight improvement after the operation, though still distinctly lame; still expressed pain when pressure was applied over the region of the splint.

On 18th May the animal was still lame, but the wound had not yet healed. Unfortunately, I have been unable to trace this case any further.

CASE 19.—Cab mare, aged, been in present owner's possession eight months; has been lame at intervals on the near fore leg ever since; suffering from ringbone, large exostoses on inside and outside of the fetlock, and another in front of the knee. Was now too lame for work.

27th April 1896. Median neurectomy under chloroform. After the operation could not detect the slightest lameness; was sent to work 27th or 28th May; has been at regular work ever since, and has not been lame again. I saw the mare a few weeks ago, and could not detect the slightest difference in action or in any other way between the two legs.

CASE 20.—Cart gelding, aged, been very lame near fore for three months, suffering from a splint about as large as a tangerine orange.

29th April 1896.—Median neurectomy under chloroform; after the operation there was a great improvement, although the lamenesss had not all disappeared. This case progressed favourably and was sent to work at the end of May; the animal has worked regularly since, and has not showed any sign of lameness.

CASE 21.—Cab gelding, aged; had been in present owner's possession about sixteen months; been too lame to work for the past five weeks. Very lame near fore leg; the cause was somewhat obscure; the animal had a small ringbone, and expressed pain when pressure was applied to the posterior part of the fetlock region.

29th April 1896. Median neurectomy under chloroform. The animal struggled a great deal when being cast, and after the operation was decidedly more lame than before. This increase of lameness persisted for about a week, and was probably due to some injury whilst struggling, but ultimately passed off. The patient was sent to work on the 17th of May, and is working regularly now.

CASE 22.—Cab gelding, aged, very lame both fore legs; owner said that animal had occasionally been lame during the past twelve months, and had been much too lame to work during the past four weeks.

The lameness was diagnosed as being due in each case to large splints which extended somewhat underneath the tendons, that on the near leg being about the size of a walnut, that on the off leg being about the size and shape of half a tangerine orange.

29th May 1896. Median neurectomy under chloroform was performed on both fore legs. After the operation the animal was still lame, though improved.

17th June.—The animal was discharged as being fit for work, the lameness having all disappeared, but the owner decided to turn it out to pasture. Up to the present time (August) there has been no return of the lameness.

CASE 23.—Cab mare, aged; very lame near fore leg, has been in present owner's possession about seven weeks; too lame to work for last six weeks.

4th June 1896. Median neurectomy under chloroform; no lameness in that leg after the operation, but now the mare showed signs of lameness on the other one. Two days later the other leg was operated upon in the same way and with the same success. When seen last, at the end of June, the animal was quite fit for work, but I have been unable to trace the case further.

CASE 24.—Cab gelding, ten or twelve years old, suffering from ringbone and old-standing sprained tendons. Would work about an hour and then fall lame.

15th June 1896. Median neurectomy under chloroform. Did not notice the case immediately after. Went on well, and was sent to work in July; this animal is at present (September) working regularly, and has not been at all lame since.

CASE 25.—Pony gelding, aged, suffering from old-standing sprained tendon and large ringbones; had been very lame for about eight weeks.

19th June 1896. Median neurectomy under chloroform; after the operation the lameness was much decreased; what there was left was probably mechanical and due to the shortened tendons. This case was unsuccessful, and the animal became very lame again and was eventually destroyed.

Remarks.—Perhaps this case might have improved if ulnar or external plantar neurectomy had been performed, but the owner did not wish it, and preferred to have his animal destroyed.

CASE 26.—Van mare, nine or ten years old, had been in present owner's possession six months, been lame one month. Was very lame, apparently from a large diffuse splint on the inside of the off fore leg.

22nd June.—Median neurectomy was performed by Mr Pierce, without any anæsthetic. After the operation the animal was still lame when trotting, though much improved. On the 3rd of July there was no lameness whatever, and on the 9th the animal was sent to work; the mare has been working regularly ever since, and has given no further trouble.

CASE 27.—Cab mare, very lame, suffering from an exostosis on the inside of the knee bones; has been lame for some months.

16th July 1896. Mr Pierce performed the operation, no anæsthetic being used. When trotted afterwards the lameness was much decreased.

30th July. Still lame when trotting, but wound not yet healed. I have not been able to trace this case any further.

CASE 28.—Cab mare, aged, very lame; suffering from ringbone and navicular disease.

17th July 1896. Median neurectomy under chloroform; did not see the animal trotted immediately after the operation.

7th August. As there was no sign of improvement, plantar neurectomy was performed on each side; after this operation there was no lameness at all. This case is still under observation but promises to come to a successful termination.

CASE 29.—Cab gelding, fourteen or fifteen years old, very lame, suffering from an exostosis on the antero-internal aspect of the knee.

17th July 1896. Median neurectomy under chloroform; walked decidedly better after the operation, though still trotted lame; this all passed off; the animal was sent to work the first week in August, and is now working regularly.

CASE 30.—Cab gelding, aged, suffering from very large splint and thickened tendons on both fore legs, very lame near fore, and owner says is often lame on off fore. Has been in present owner's possession four months; been very lame for ten weeks. Has been severely fired before in present owner's hands; has been blistered seven weeks ago and turned out to pasture with no improvement.

29th July. Median neurectomy under chloroform on both fore legs; after the operation, when the animal had trotted for a few moments, there was no lameness perceptible. This case progressed favourably, was sent to light work during the last week in August, and is now working regularly.

CASE 31.—Cart gelding, seven years old, very lame off fore from an excessively large and awkwardly placed splint directly under the tendons. Had been lame six weeks; was fired and blistered about a fortnight ago.

29th July. Median neurectomy under chloroform; no visible improvement after the operation.

12th August. Still very lame; applied a blister over the region of the splint; wound healing well.

This case is still under treatment (September).

CASE 32.—Cab mare, eight or nine years old, very lame off fore, suffering from ringbone, exostosis on each side of the fetlock joint, atrophied frog, and concave sole. Had been in present owner's possession a month, and been too lame to work all the time; had previously been fired.

10th August. Median neurectomy under chloroform; after the operation the animal was decidedly improved, though still lame.

This case is still under treatment. I think that external plantar neurectomy will probably have to be performed.

CASE 33.—Trap gelding, ten or twelve years old, very lame near fore, suffering from ringbones, several chain splints, and exostosis on the inside and outside of the fetlock. Was fired from knee downwards five weeks ago, and turned out to pasture with no improvement.

13th August. Median neurectomy under chloroform; after the operation there was a slight improvement, but the animal was still too lame to work.

28th August. Removed the external plantar as the animal was still very lame; this made a decided improvement.

The case is still under treatment, but promises to end successfully.

CASE 34.—Cab gelding, aged, very lame on the near fore, suffering from large splint extending underneath the tendons and ringbones.

21st August. Median neurectomy under chloroform; decidedly improved after the operation, though still slightly lame.

28th August. Going on well; gives prospect of complete recovery.

The case is still under treatment.

CASE 35.—Pony gelding, six years, excessively lame on the near fore; had been so for three months; in present owner's possession eight months; suffering from a large diffuse splint under the knee and tendons of the near fore leg; no other abnormality could be detected.

21st August. Median neurectomy under chloroform; no improvement whatever after the operation.

This case is still under treatment.

CASE 36.—Cab mare, fourteen or fifteen years old, very lame on the near fore; has been lame off and on for about nine months, and excessively lame during the past three weeks; is suffering from ringbones and splint about as big as a walnut at the back and inside of the leg immediately under the tendons; had been severely fired about twelve months ago.

26th August. Median neurectomy under chloroform; after the operation the animal showed no lameness whatever.

This case is still under treatment.

Summarising the above, it will be seen that the results are very satisfactory. Out of the thirty-six cases seven are still under treatment, two were not at all improved, and twenty-four have been sent to work; of the latter I know that eighteen are working regularly, two were sent to work but have died from other causes, one worked for ten weeks and was then sold, thus being lost sight of, and three were unable to be traced. Five animals were operated upon in both fore legs.

Of course, like all neurectomies, it is not an operation which is to be indiscriminately advised. The chief sequelæ to be feared are those of softening and ultimate rupture of the flexor tendons, and sloughing of the hoof; but, according to those who have largely practised median neurectomy, the percentage is small; there has scarcely passed sufficient time as yet to venture an opinion in the above cases. In regard to these accidents, we must not forget that there is still a certain amount of nerve supply to the whole of the outside of the limb from the branch of the ulnar nerve which joins the external plantar, and that the same branch supplies the outer side of the foot.

For old-standing lameness, where due to splints, exostoses anywhere on the inside of the leg, chronically sprained, thickened, and painful tendons, or cases of that kind which cause pain by pressing on the adjacent nerve structures, after all other treatment has failed, the operation is certainly to be recommended; but for ringbones, sidebones, exostoses on the fetlock, navicular disease, or lameness caused by anything below the usual seat of plantar neurectomy, there is no advantage over this last operation; in fact, there is the disadvantage

that one has unnecessarily deprived a large portion of the leg of its normal nerve supply.

It is worthy of notice that although in some cases there was immediate improvement when the animal was trotted after the operation, in others this was very slight but as the wound healed the lameness completely disappeared.

EQUINE TUBERCULOSIS.

By J. M'FADYEAN, Royal Veterinary College, London.

IT is perhaps not uninteresting to recall the fact that when, in the first volume of this Journal, eight years ago, I published a note regarding two cases of tuberculosis in the horse, an eminent veterinary teacher endeavoured to throw discredit on the observations, maintaining that the horse was immune against tuberculosis, and that the alleged cases were probably examples of glanders. Since that date it has become generally recognised that the horse possesses no immunity against tuberculosis, and that instances of the disease in that species are far from being rare.

In an article which appeared in Vol. V. of the Journal I published notes of other cases in which the nature of the disease was verified by the discovery of Koch's bacillus in the lesions, and since that date upwards of ten cases have annually come under my notice. In the greater number of these cases my acquaintance with them was limited to an examination of portions of spleen, lung, or other organ sent to me in order that I might confirm the diagnosis made by those in whose practice the cases had occurred. In a number of the cases, however, I had an opportunity to see the animal alive and to make a *post-mortem* examination, and a few of these I shall here describe.

CASE I.

The subject in this case was a black pony, aged, and about thirteen hands high, which was admitted to the College Infirmary in December 1893. The early history of the animal was not obtainable. It was generally unthrifty, and one of its submaxillary glands was enlarged to the size of a pullet's egg, and much indurated. In consequence of these symptoms the animal came under a suspicion of glanders, and it was tested with mallein. This was not followed by any reaction, but at that time our experience with mallein had not been wide enough to justify absolute confidence in it when its verdict seemed opposed to the symptoms. Indeed, I may say that both Professor Macqueen (under whose care the pony then was) and myself were so satisfied that the animal was glandered that we set this down as a case in which mallein had given a wrong verdict. The case was therefore notified to the Veterinary Inspector of the district, and the pony was slaughtered on the 1st of January 1894. But no sooner were the abdominal viscera exposed than it became quite obvious that if the case was one of glanders it was at the same time one of tuberculosis. The following are the notes of the *post-mortem* examination :—

One of the mesenteric glands is enlarged to the size of a hen's egg, and on section it is found to be caseous in its centre.

The spleen is much enlarged and contains numerous tumour-like growths; these have a firm consistence, and on section some of them show traces of caseation.

The intestines are normal as regards their exterior (not cut open).

The liver is greatly enlarged (weighs 29 lbs.), and is in a condition of fine cirrhosis.

The lungs are both uniformly crammed with miliary tubercles about the size of a mustard seed. Near the diaphragmatic edge there are a few larger tubercles (nearly as large as a pea); some of these on section are translucent, and others show some central degeneration. The bronchial glands are normal.

One of the submaxillary glands is as large as a hen's egg, and very dense in consistence; on section it is found to be extensively caseated.

The septum nasi is normal.

Cover-glass preparations made from one of the splenic tumours, one of the pea-sized pulmonary tubercles, and the caseated centre of the submaxillary gland showed in each case numerous tubercle bacilli.

The most interesting points in this case were the presence of an undoubtedly tuberculous lesion in the submaxillary gland, the strong suspicion of glanders thereby excited, and the correctness of the indication afforded by the mallein test.

Case II.

In this case the subject was a brown half-bred mare admitted into the College Infirmary in October 1894. Fortunately the mare up to the time of her admission to the College had never been out of the hands of the gentleman who bred her and who furnished the following history.

Foaled on the 25th March 1890; sire, a thoroughbred stallion; dam, a light cart mare.

The dam got exposed the day of foaling, and died from inflammation of the lungs on 27th March. The foal was therefore brought up by hand, and throve very well, never showing any signs of "pot belly" or slackness in the back. She grew and did well up to October 1893, having been out at grass during the summers, and during the winters taken up in a loose-box on peat moss litter, fed with oats and hay, but let out to grass in the daytime. In October 1893, she showed signs of being amiss, and was off her food; she was treated for "bots," given some condition balls, and sent to the farm, where she had a large loose-box to herself, and plenty of wheat straw, with three good feeds of corn a-day. As she got no better but lost condition she was brought back towards the end of January, to be under the owner's own eye. She was then very weak, would not feed, and remained lying down the greater part of the day. She was given powders, tonic balls, and warm drinks with ale, which were continued for a month. Under this she began to feed well in about a fortnight, though she did not improve in condition. She was turned out to grass in May, coming

in at nights and getting two feeds of corn a-day with crushed linseed cake. She remained out at nights after the first week in June. She was served by a young thoroughbred horse on 23rd May and 13th June, and had not been in use since. From June to September she remained in much the same state, feeding well, but not putting on flesh or improving in condition, spending much time lying down, evidently weak, and unable to trot with the other mares. On 14th September she got down in the watering-place of the field she was in, and had to be dragged out (she may have been fast from twenty minutes to one hour and a quarter). As it was impossible to get her on her legs that night, she was given warm mashes and drinks, well clothed and bandaged, and covered with straw, till next morning, when she was hauled on to her legs by ropes and pulleys, and taken home—a distance of about a quarter of a mile. She was then put in slings, and gradually recovered the use of her limbs so far as to permit of her being turned out to a warm paddock during the day. Her appetite remained good, and she has been liberally fed with oats, bran, boiled linseed, and good hay.

The above is the history of the mare up to the time of admission to the College Infirmary. Little remains to be added to it, except to say that she was very emaciated, and had a scurfy, unhealthy-looking skin, and some swelling of the legs.

The case was diagnosed as one of tuberculosis, and the mare was slaughtered on the 15th October 1894. The following are the notes of the autopsy.

Carcase badly nourished; very little subcutaneous or intermuscular fat; some œdema underneath chest and abdomen.

Peritoneum covering large intestine studded with occasional villous growths.

Spleen weighs 1 lb. 14 oz. In the capsule and partially embedded in the splenic substance there are four tumours about the size of a hazel nut, and a number considerably smaller. The hilus lymphatic glands are enlarged—one of them up to the size of a pigeon's egg.

Mesenteric lymphatic glands enlarged so as to form a mass twice as big as a man's head. In this mass it is difficult to detect the individual glands, but some of them as large as a cocoa-nut can be distinguished.

The only normal lymphatic glands of the group are those belonging to the first part of the small intestine; lacteals everywhere very distinct; many of the mesenteric veins are enormously distended and tortuous.

Kidneys congested; Malpighian bodies very distinct; otherwise normal. Weights:—right, 2 lb. 7 oz.; left, 2 lb. 7 oz.

Portal lymphatic glands much enlarged, forming a mass continuous with the enlarged mesenteric glands, for the most part fibrous, but with some caseous spots on section.

Diaphragmatic surface of the liver studded with fibrous thread-like growths. Immediately underneath the capsule there are a few small tumours about the size of a pea. On section the colour of the liver is greyish brown, lobulation fairly distinct, and some pea-sized tumours revealed in its substance, but otherwise normal in appearance. Weight, 19 lbs. 8 oz.

One pea-sized caseating nodule, submucous in position, in the first

part of the jejunum. Two other small submucous nodules found close together in the ileum. A few ascarides in the small intestine.

Lymphatic glands between the first and fourth portions of the double colon are variously enlarged, up to the size of a hen's egg. The colic veins are distended and tortuous. Large intestine normal.

Small quantity of dropsical fluid in the pleural cavity. The diaphragm and chest wall are studded with commencing *perlsucht* growths. Prepectoral lymphatic glands greatly enlarged. Projecting into the anterior part of the chest is a tumour as big as the two fists. Pericardium contains about a pint of dropsical fluid.

Bronchial glands on both sides slightly enlarged, and show some caseous points on section.

The pleura along the upper aspect of each lung shows some thready or villous growths on its surface. Lung substance normal. Pharyngeal, submaxillary, inguinal, and prescapular glands normal.

This animal, it will be observed, had been reared on cow's milk. This point will be referred to again later on. In reply to specific inquiry the owner stated that he had never previously lost a horse by the same disease, and, so far as he was aware, there was no tuberculosis among his cattle. Besides, the mare had never been grazed with cows except during the summer before her death, at which time she was already affected with the disease. No consumptive person had ever attended to the mare.

CASE III.

For having brought this case under my notice I am indebted to Mr Dawes, F.R.C.V.S., of West Bromwich. In January last Mr Dawes wrote to me as follows:—

"About a fortnight ago I was called in to see a carriage horse which, the coachman said, was not feeding very well and had become stiff in his movements. I found, on examination, that the horse was unable to bend his neck, and that several of the cervical vertebræ were swollen and presented rather a lumpy appearance. The swelling was very hard, and painful on pressure. I was informed that the horse had not met with any accident, and was always kept in a large loose-box. I had him removed to my yard, and he appears to keep getting worse.

"About three weeks ago I saw a case which presented similar appearances to this one at another veterinary surgeon's yard; he had the animal slaughtered, and his opinion was that it was a case of tuberculosis. With reference to my case, the horse has a slight cough, pulse 54, temperature normal, but he looks rather haggard. As this horse is insured for rather a large amount the owner is very anxious about it. If it is not troubling you too much I should be glad to know what you think about it."

To this I replied that from the symptoms I had no doubt that the horse was tuberculous, and I suggested that he should be tested with tuberculin. This was accordingly done by Mr Dawes, with the result shown below. The time of injection was 11.30 A.M., on the 15th January.

15th January, 11.30 A.M.	Temperature,	101°
" " 8.30 P.M.	"	104°
" " 11.30 P.M.	"	104·2°
16th " 2·30 A.M.	"	104·2°
" " 5.30 A.M.	"	103°
" " 9.45 A.M.	"	101·3°

The diagnosis of tuberculosis was thus confirmed by the test, and after some months, during which the condition of the horse showed no improvement, Mr Dawes, with the owner's consent, had him sent to the Royal Veterinary College. On the 17th of May he was again tested with tuberculin. The injection was performed at 6.30 A.M., and the result was as follows:—

Time.	*Temp.*
6.30 A.M.	100·6°
9.30 A.M.	100·6°
12.30 P.M.	101·2°
3.30 P.M.	103·2°
6.30 P.M.	103·8°
9.30 P.M.	103·2°

The reaction, although not great, distinctly denoted tuberculosis. Four days later, viz., on the 21st May, at midnight, the horse was tested with mallein, and the temperature during the following fifteen hours is shown below.

Time.	*Temp.*
12 midnight	100·2°
6 A.M.	99·4°
9 A.M.	99·8°
12 noon	102°
3 P.M.	101°

There was, it will be noticed, an erratic rise of temperature at the twelfth hour, but only to 102°, and the local reaction was small and soon disappeared.

The horse at this time was by no means so emaciated as animals in the last stage of tuberculosis usually are. The appetite was good, and the only marked abnormality observable was the peculiar stiffness of the neck, and an ill-defined hard swelling, sensitive to pressure, over the second and third cervical vertebræ.

The horse was slaughtered on the 23rd of June last, and the following are the notes of the autopsy.

Carcase fairly well nourished.

Peritoneum normal.

Spleen enlarged; weight, 5 lb. 15 oz. In its substance there are a number of tumour-like enlargements; the largest is situated near the base, and is as big as a cocoa-nut; the second largest is situated midway down the convex edge, and is as large as a goose egg. The surface of each of these is centrally depressed, and the capsule of the spleen over them is replaced by dense white scar-like tissue. Smaller tumours are embedded in the splenic substance. On section the tumours are found to have a very firm consistence, and the cut

surface is yellowish-white, and shows no distinct necrosis or caseation. The splenic lymphatic glands are a little enlarged and congested.

The mesenteric glands and those of the large intestine appear normal (incised and carefully examined).

The mucous membrane of the stomach and intestines is normal throughout.

The liver has some fibrous growths on its surface; underneath its capsule there are some white densely fibrous tubercles, mostly about the size of a pin's head; and in its substance there is one tumour similar in appearance to the splenic tumours, and nearly as large as a walnut.

Kidneys normal.

In the lungs there are numerous pin-head firm tubercles about the size of a mustard seed, so firm as to suggest that they are calcified. Between the right lung and the chest wall there is a fibrous adhesion over a patch as large as the palm of the hand. Bronchial and tracheal glands normal.

Heart normal.

Tongue and throat normal.

The cervical vertebræ, when freed from the soft textures by maceration, were found to be all more or less diseased with the exception of the atlas. The second and third were the worst affected. These were at some places considerably thickened by new rough spongy bone. Spiny points of new bone were developed around some of the articular surfaces, and in one of the bones the disease involved the articular head.

Case IV.

The subject in this case was a dark bay gelding, six years old, the property of a client of Mr H. Collett, M.R.C.V.S., of West Bromwich. Mr Collett kindly arranged to have the horse sent to the Royal Veterinary College, where it was killed on the 19th of October 1895. The following are the notes of the autopsy.

Carcase profoundly emaciated. All the limbs, but especially the hind ones, much swollen from œdema. Over the entire body the hair is matted together by a somewhat greasy scurf, of a greyish colour; the hair is easily pulled out. The inner surface of the thighs is excoriated and deprived of hair. Prepuce is much swollen from œdema. Œdema of the connective tissue on the under aspect of the body.

Superficial inguinal lymphatic glands on each side much enlarged; each group about the size of the fist; gland tissue œdematous. Peritoneal cavity contains a quantity of dropsical fluid, estimated at about a gallon. Peritoneum normal save over the diaphragm. The mesenteric glands belonging to the first 15 or 16 feet of the intestine are enlarged to form a mass as big as the two hands; in this mass it is not possible to distinguish the individual glands.

Stomach and intestines normal.

Spleen. The lymphatic glands along the hilus are enlarged, the largest being the series opposite the base. The spleen is enlarged, and in its substance there are several tumours about the size of pigeon's eggs; on section these are firm, but caseating.

Liver enlarged, weighs 17½ lbs. On the diaphragmatic surface there are three "milk spots," the largest about the size of the palm of the hand. Underneath the capsule, and partly embedded in the liver substance, there are numerous tubercles, the largest being about the size of a small pea. The liver tissue shows slight nutmeg lesion. Underneath the diaphragmatic peritoneum there is an abundant crop of pinhead tubercles; these tubercles are most abundant over the muscular rim on the right side. The hepatic lymphatic glands are not much enlarged.

Kidneys normal in appearance; together they weigh 4 lbs.

The parietal and visceral pleura of left side of chest normal. Some of the prepectoral group of lymphatic glands are slightly enlarged and show pinhead tubercles.

Left lung. Underneath the pleura, but visible through it, there are numerous tubercles, varying in size from a small pea to a pin's head. Only a few such tubercles are present in the depth of the lung tissue.

Right lung. The pleura on the upper aspect of the lung and on the diaphragmatic surface shows at different places small rounded fleshy growths. Immediately underneath the pleura there are a few tubercles, but none in the depth.

The left bronchial gland is enlarged to three times the normal, is fibroid in consistence, and shows caseous centres on section. Some of the tracheal glands show pinhead yellow tubercles.

Pericardum contains about half a pint of fluid.

Heart. Weighs 8½ lbs. Wall of right auricular appendix much thickened, with a consistence at some parts bony and at others cartilaginous. In the wall of the sinus venosus there are some calcified or ossified islands. Heart otherwise normal.

Pharyngeal and submaxillary lymphatic glands normal.

Thyroids normal. Tongue and throat normal.

CASE V.

The subject in this case was a black Belgian stallion, rising six years old, which had for some time been under observation by Mr Burrell, M.R.C.V.S., London, on account of general unthriftiness. The early history was not obtainable. Mr Burrell was good enough to allow me to make a *post-mortem* examination of the animal when he was killed on the 5th February 1895. The lesions found were as follows:—

Left bronchial lymphatic gland enlarged to size of hen's egg. Firm, almost fibrous consistence; no distinct caseation on section. Group of glands under the trachea, in front of heart, similarly enlarged and indurated. *Perlsucht* growth on pleura of each lung on both outer and inner surface for 4 or 5 inches along lower edge. Lung tissue normal.

Perlsucht growth on epicardium; well marked on left auricular appendix, and at places on surfaces of ventricles also. Right auricular appendix has its wall greatly thickened and indurated. Except along lower edge of appendix, parallel to auriculo-ventricular furrow, the muscular tissue of the wall is almost entirely

replaced by new growth of cartilaginous consistence. On section this grates under the knife from calcification or ossification.

The scrotum on each side under the testicle is greatly thickened. On section the thickening is found to take the form of dense fibrous connective tissue next the skin, but towards its upper limit the tissue is somewhat softer in consistence and yellowish-pink in colour. The right testicle is free in the scrotal sac, but its surface shows some villous fibrous-looking growths. The left testicle is for the most part adherent to the scrotum. The testicular substance is normal in appearance.

One mesenteric gland close to the spine is enlarged and indurated.

Spleen contains about a dozen tuberculous tumours—the largest as big as a hen's egg. Nearly all these are visible in the uncut organ, and project above the normal surface. The tumours have an almost fibrous consistence. On section they show a yellowish-white surface, studded with dark red points and streaks. The spleen pulp is of normal consistence, and shows large distinct Malpighian bodies. The lymphatic glands along the hilus are all enlarged, the largest being as big as a hen's egg. Most of these on section are abnormally vascular, but the larger ones are beset with firm yellowish-white areas up to the size of a hazel nut.

The liver shows at various places under the capsule a number of yellowish-white nodules up to the size of two barley grains. The diaphragm has some *perlsucht* growths on both its surfaces.

Kidneys normal.

The submaxillary, prescapular, prepectoral, and deep inguinal lymphatic glands normal in size and appearance. The superficial inguinal glands are slightly enlarged, but not visibly tuberculous.

Microscopic examination showed that the induration of the right auricular appendix was not due to a tuberculous lesion, but to the partial replacement of the muscular tissue by cartilage and islands of bone.

It is doubtful whether these five cases illustrate any new feature of equine tuberculosis, but there are two points that they serve to bring into fresh prominence.

The first of these is the implication of the cervical vertebræ, which was present in Case III. This is not the first occasion on which marked stiffness of the neck has been noted as a striking symptom in tuberculosis of the horse. Four years ago[1], in giving particulars of a case which occurred in the practice of Mr M'Connell, M.R.C.V.S., of Wigtown, I figured the nature of the lesion which explained the stiffness of the neck that was present in that instance, and since that date the combination of disease of the cervical vertebræ and manifestly tuberculous lesions elsewhere in the body has several times been brought under my notice. In this number Mr Hill, of Glasgow, describes a case in which the stiffness of the neck was present during life, and explained after death by the discovery of disease of the cervical vertebræ, and the combination has been met with too frequently to admit of its being set down as a mere coincidence. There can be little doubt that the lesion is a tuberculous

[1] Vol. V., p. 248.

ostitis and periostitis, most probably due to infection by way of the lymphatic vessels of the neck, either from the throat or from the thoracic cavity.[1]

The second point that is raised afresh by the foregoing cases is the mode of infection in equine tuberculosis. Bang and others have supposed that horses usually contract the disease from tuberculous cows, either by the way of direct cohabitation, or through the transference of fodder from the byre to the stable. In this Journal several years ago (Vol. V., p. 155) the view was put forward that some cases of equine tuberculosis might be due to infection with cow's milk. This was suggested by the fact that in a considerable proportion of cases there was a distinct history of the animal having been largely fed with such milk, and it may be observed that such a history was obtainable in two of the six cases described in this number (including Mr Hill's case).

In two other cases brought under my notice during the last twelve months there was a similar history. Now, when one reflects that certainly not one horse in several hundreds is at any period of its life fed on cow's milk, the frequency with which tuberculosis has been met with in horses that had been so fed becomes very striking.

A new interest has been given to this question by some recently published observations by Professor Nocard.[2] On the ground of certain minor peculiarities possessed in common by cultures obtained from cases of avian tuberculosis and others obtained from a case of equine tuberculosis of the abdominal type, M. Nocard believes that the abdominal type of disease in the horse is caused by the organism which is responsible for tuberculosis of fowls. In other words, he thinks that horses are usually infected, not from cows or other mammals, but from fowls. In some cases, however, viz., those in which the primary lesions are in the lungs, the equine disease appears to be caused by the mammalian bacillus. Inoculation experiments made by M. Nocard confirm this view, for he finds that the guinea-pig, which possesses a considerable degree of immunity against avian tuberculosis, is also very resistant to inoculation with the bacillus obtained from equine tuberculosis of the abdominal type.

Now no one will venture to doubt the correctness of the observations just referred to, but, nevertheless, one may hold that the generalisation is too hasty, and that the proof that abdominal tuberculosis of the horse is always or generally of avian origin is as yet far from complete. If it is the rule that the guinea-pig offers a considerable degree of resistance to inoculation from the abdominal type of the disease, that rule is not absolute, as the following instance will show.

On the 2nd of January 1894, a guinea-pig was subcutaneously inoculated on the back with one of the larger tubercles from the lungs of the pony referred to in this article under the head of Case I. Needless to say, the usual precautions against accidental infection

[1] My friend Mr John Malcolm of Birmingham informs me that some five or six years ago he saw a mare in consultation with the late Mr F. J. Insall of Coleshill, who had diagnosed the case as one of tuberculosis from the symptoms of stiff neck and swelling along the course of the cervical vertebræ. Mr Insall declared that he had seen the same condition in several previous cases of equine tuberculosis, and in this particular case his diagnosis was verified by the *post-mortem* examination.

[2] *See* last number of this Journal, p. 171.

were observed. The guinea-pig was found dead on the 6th of April 1894, and the autopsy of it revealed generalised tuberculosis, with lesions in the spleen, lungs, and liver, as well as in the lymphatic glands. Microscopic examination showed the presence of tubercle bacilli in these lesions. Here, then, was a case of equine abdominal tuberculosis in which the disease, as judged by its generalisation in the guinea-pig, was of the mammalian and not of the avian type. Unfortunately, no attempt to cultivate the bacilli either from the equine lesions or from those in the guinea-pig was made, and therefore no evidence derived from the characters of the bacilli in culture can be offered from this case.

In conclusion, it may, I think, justifiably be held that there is still strong reason to suspect cow's milk as the most common vehicle of infection in tuberculosis of the horse, and that the practice of prescribing raw cow's milk for sick horses, or of giving it as a fattening article of diet to stallions, is attended with a considerable degree of risk, unless the cows that furnish the milk are known to be free from tuberculosis.

SCIRRHOUS CORD. BOTRIOMYCOSIS EQUI (BOLLINGER).

By JOHN B. WOLSTENHOLME, F.R.C.V.S., Manchester.

IN April 1895 my attention was drawn to a light cart gelding with this affection. He was then nine years old, and had been in the same employment for four years. The tumour was about 3 inches in diameter, with a slight discharge from a small sinus. Treatment was not adopted, and the horse worked on until 24th November, at which date the swelling was some 8 inches in diameter, and interfered with locomotion. There was a suppurating ulcer three-quarters of an inch in diameter at the most dependent part. Some œdema was also present.

By means of fomentations, enlarging the wound, etc., the swelling was reduced, and the horse more at ease.

On the 29th of same month he was cast, chloroformed, and put on his back; and with the assistance of Messrs Chorlton and Priestner the tumour was removed. The growth was pear-shaped, the base being downwards, at which part the skin was intimately connected with the tumour. Measurements—length, 10 inches; greatest diameter, 5½ inches; diameter of neck, 1½ inches; weight, 3 lbs. 13 ounces.

The peduncle was divided by the actual cautery; all hæmorrhage ceased, and the skin was sutured. Very considerable bleeding ensued, however, during the struggles before and during rising, which necessitated plugging of the sac. The operation lasted one hour; the horse made a good recovery.

The removed mass was dense and firm; on section the colour was of a delicate pale pink. At the centre there existed an abscess 2½ by 1½ inches, which communicated by means of sinuses with a larger one in connection with the ulcerated base. On further examination of the section numerous small areas are noticed, more or

less rounded, varying in size from the diameter of a millet seed to that of a large pea. They are grey in colour, soft and granular in texture, whilst the immediately surrounding fibrous tissue is discoloured and darker than the rest, being of a pale brown.

As the section is being cut these areas appear to give way somewhat before the knife, and a small space is formed between them and the surrounding tissue. In places this space is considerable, and the borders have an irregular eroded appearance. On the free surfaces of the growth, in certain places, small nipple-like projections may be seen; they correspond with the grey areas just described. They are about one-sixteenth of an inch in diameter, and project about the same distance above the surface. Around each is a depressed areola, with a diameter of three-sixteenths of an inch. At the summit of the nipple is a depressed centre, and the raised marginal ring is studded with minute mulberry-like projections.

In some instances ten or twelve of these projections are grouped on little mounds of the tumour tissue of about three-fourths of an inch in diameter. I must say that I do not remember to have noticed the nipple-like projections before the tumour was put up in spirit, but that examination was not thorough. They are very distinct now.

Before describing the more minute structure of the growth, I would refer to Zuil's translation of Friedberger and Fröhner's "Pathology and Therapeutics of the Domestic Animals," p. 496, where it is stated that the causal organisms "are micrococci and not fungi;" and that Bollinger "has advised the designation of the disease by the expression botriomycosis (colonies in the shape of *grapes*)."

This term of course includes the new growth; the name botriomyces being restricted to the organisms themselves. Although now regarded as separate and distinct from the actinomyces (fungi), they bear a close resemblance not only in the colonies, but in the structure and arrangement of the new tissue formation, as seen in actinomycosis of the tongue, and the disease under notice.

For microscopical examination portions were hardened in (*a*), Müller's fluid, (*b*), picric acid, (*c*), alcohol; all of which cut easily with the freezing microtome, and stained readily. It was found to be an advantage to embed the portion of tissue in celloidin before cutting, as by this means the softer parts were more securely retained ***in situ***. Without this precaution many sections contained all the parts, and were not difficult to manipulate.

The stains used were—(*a*), picro-carmine; (*b*), hæmatein, followed by picro-carmine; (*c*), hæmatein, followed by rubin and orange combined; (*d*), the Plaut method.

Method (*c*), viz., hæmatein, rubin, and orange, gave the most perfect differentiation; and the references I make are to sections which have been stained in this manner. The others, however, were also good.

Under a low power (Fig. 1, Plate III.) the component parts are well marked, and consist of (A), recent fibrous tissue; (B), granulation tissue; (C), the colony or zooglœa of micrococci. The fibrous-tissue is stained pink, and its nuclei, which are stained purple, are very numerous, and appear as minute specks in a delicate fibrous growth.

The granulation tissue (B) is that which makes up in great part the

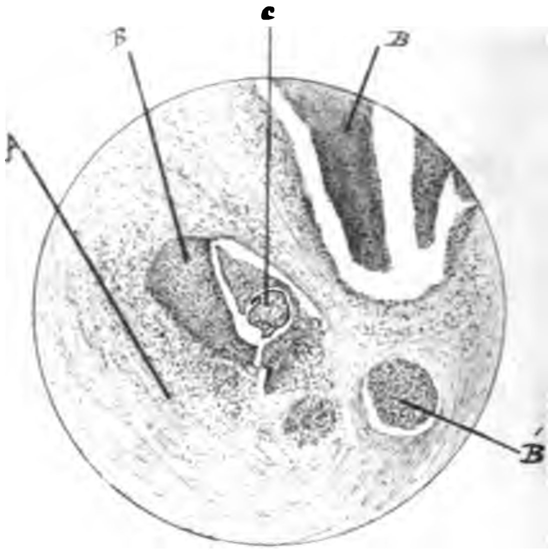

Fig 1.

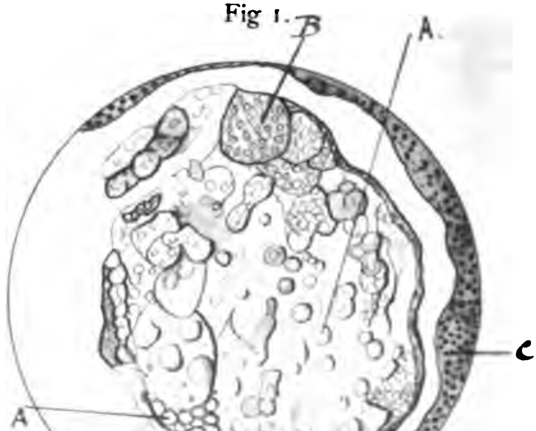

Fig 2.

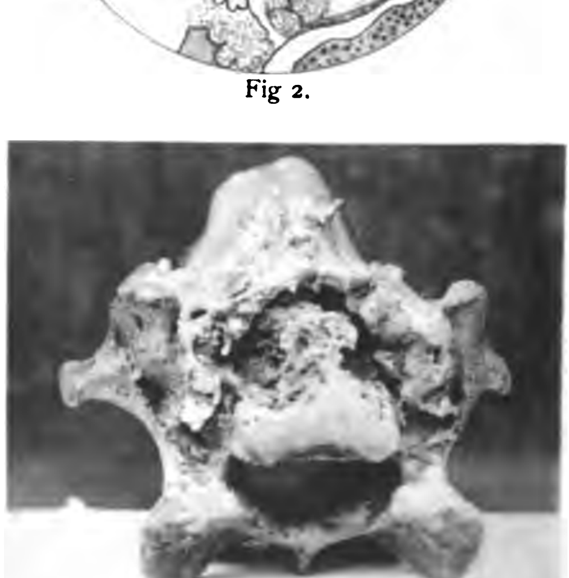

Fig 3.

rounded grey areas already described; then stated as varying from the diameter of a millet seed to that of a large pea, *i.e.*, from 1 to 6 mm. But in mounted sections much smaller areas are visible to the naked eye, as well as with the microscope, the smallest seen in the sketch being ·3 mm. diameter (B). Under this power such an area appears as a granular purple mass, composed of small round cells; the colour of the whole being due to that of the deeply stained nuclei.

Various authors allude to these areas as "tubercles," on account of the close resemblance they bear to the new growth of that name, caused by the irritation of the tubercle bacilli.

The colonies, one of which is shown at C, are found within the so-called tubercles, and vary much in size. From being exceedingly minute, they may extend to about ·25 to ·35 mm. diameter, that in the sketch being rather smaller than ·20 mm. Some of the colonies have taken a deep orange stain, others are variegated, pink, orange, and pale green. In shape they are more or less spherical. In some specimens it would appear that the granulation tissue had been lifted away from the outer circumferent part of the colony, without cutting it, and so producing a plain surface. Under these conditions spheroidal bodies about ·03 mm. diameter may be seen. They are arranged after the manner of grapes in a bunch; the investing membrane of each being prolonged and so gathered as to form a kind of stalk, which unites them to each other, and thus into a bunch or colony. This is well seen under the 1-inch objective, whilst the shading and focussing plainly demonstrate their globular form. Some of these grape-like bodies, when examined with a higher power—an immersion one-twelfth—are seen to be filled with other round bodies; these latter have a diameter of 3μ or smaller.

It may be convenient at this point to place in juxtaposition the approximate diameters of the parts I have been describing, thus:—Colony, diameter, ·2 mm.; grape-like body, ·03 mm.; contents of grape-like body, cocci, ·003 mm., or 3μ. In other of the grape-like bodies it is not possible definitely to make out the presence of the internal spheres, but the different shading points to the contents having been so divided up.

What I have just attempted to describe has special reference to the periphery of a colony which was in relief; it had not been cut with the microtome, and was of an orange colour.

I now wish to refer to a colony seen in section, and I select that from which the sketches have been made. Under the inch it appears as an area with different degrees of staining, the periphery having taken the deepest. Under the one-sixth inch the colony is seen to be made up of rounded (grape-like) bodies, some of which are of a pale orange, and others of a pale green tinge. They are more or less separated from each other by a homogeneous material which is stained pink. In the interior of some may be seen the smaller cells. Under the one-twelfth inch oil immersion it is noted that those at the periphery of the mass are the most deeply stained, are orange coloured, and filled with the smaller round elements—cocci, which are about 3μ diameter. As the centre of the colony is approached, they are stained differently, being of a pale green or grey colour. Some present no trace of other cells in their interior, and appear to be simple sacs containing a gelatinous or albuminous material.

The above-mentioned parts have definite shape and well-defined borders, and they are embedded in, and surrounded by, a structureless gelatinous (?) material which has taken a pink stain.

The following works may be consulted :—Friedberger and Fröhner, "Pathology and Therapeutics of the Domestic Animals," translated by Zuil, vol. ii., p. 493; M'Fadyean, "Journal of Comparative Pathology and Therapeutics," vol. ii., p. 1, 1889; Sims Woodhead, "Bacteria and their Products."

DESCRIPTION OF PLATE III.

FIG. 1. (Leitz, obj. No. 3, Oc. No. 1); C, a colony of botriomyces; B, and B, granulation tissue; A, recent fibrous tissue.

FIG. 2. (Leitz, one-twelfth oil-imm., Oc. No. 1, draw tube 170 mm.). The same colony of botriomyces as sketch No. 1. A, examples of round bodies, stained pale green, presenting no trace of internal cells; B, grape-like body, containing cocci. C, granulation tissue.

FIG. 3.—Diseased cervical vertebra from Mr Hill's case of equine tuberculosis.

POST-MORTEM NOTES ON TWO INTERESTING CASES.

By STEWART STOCKMAN, Professor of Pathology, Dick Veterinary College, Edinburgh.

PULMONARY ACTINOMYCOSIS.

A PIECE of lung from an aged cow was kindly sent to me by Mr Riddoch, M.R.C.V.S., Inspector at the Edinburgh Abattoir, in the hope that it would be interesting to the students of the college. The suggestion was that it might be a case of verminous pseudo-tuberculosis. Under the pleura and in the substance of the lung were a number of small and very firm greyish nodules, which varied in size from a pin's head to a hempseed. They were most abundant under the pleura, but were also well distributed throughout the spongy tissue of both lungs. They were not nearly so numerous as the nodules in a case of miliary tuberculosis. There was no central softening.[1] Many of them were situated in the interlobular septa and around the smaller bronchial tubes. The borders of the nodules were very sharply defined and the lung tissue between was open. Mr Riddoch was unable to tell me whether the bronchial glands were enlarged or not, but was positive that no nodules existed on the parietal pleura or in any of the other internal organs.

On microscopical examination colonies of the actinomyces in the club form were found in the centre of the nodules. Around the parasite were fibroblastic cells. Outside the latter were spindle cells, and at the periphery was a distinct ring of fibrous tissue. A connection could be traced between many of the nodules and the bronchioles; indeed, some of them were present in their walls. They seemed to follow the distribution of the bronchial tubes. Away from the nodules the

[1] I have also seen a case of pulmonary actinomycosis in which marked softening was present in the centre of the lobules. Evidently the fibrous and caseous varieties of lesion are found in other organs as well as the tongue.

alveolar walls were thicker than normal, their epithelial lining was proliferating slightly, and a few fibroblastic cells were present. These cells had not wandered any distance from the wall, and the alveolar cavity was practically empty. As far as one may judge from macroscopical and microscopical examination, the infection had operated by way of the bronchial tubes.

PNEUMONIA IN A CALF.

Among the specimens sent to my *post-mortem* class at the Edinburgh Abattoir was the carcase of a two-months-old calf. The flesh was flaccid, dropsical, and of a red colour. The anterior lobe of the right lung was hepatised and airless. On section it appeared mottled in red and grey. Certain small areas were much denser than other parts. These denser areas had the appearance of foci, and slightly resembled an acute tubercular lesion. I carried a portion of the lung to my laboratory for further examination.

On examining sections microscopically the bronchial epithelium was found to be in a state of catarrh. Some of the air cells were filled by a dense collection of leucocytes, which almost obliterated the walls of four or five adjacent alveoli. Many of these cellular foci were on the course of the bronchial tubes, and some of them were present in the walls of the latter.

When sections were stained by Gram's method, two forms of micro-organisms could be made out in the dense cellular areas. The one had the form of cocci, the other was evidently a mould consisting of fine short threads which took the stain feebly. Away from the denser portions the alveoli contained a large number of catarrhal cells and leucocytes, but neither fibrine nor blood.

Reasoning from the usual reaction of the tissues and blood cells to pathogenic bacteria, it may be inferred that these microbes were associated causally with the pneumonic lesions. From the nature and disposition of the changes it would seem as if the microbes had entered by way of the tubes.

Semmer and Perroncito have both described cases of pneumonia in the calf, apparently due to micrococci. Attempts to experimentally reproduce the pulmonary lesion by intra-tracheal injection of cultures of these organisms are almost always attended by negative results.

Apparently a predisposing influence, almost as important as the presence of the microbes themselves, is necessary before the latter can act. It also seems probable that those cases of pneumonia which are not caused by the presence of animal parasites are in large part provoked by bacteria. Further, we know that some bacteria, harmless to a vigorous organism or tissue, are capable of causing serious lesions when present with debilitating influences.

NOTE ON THE USE OF BARLEY AS HORSE FOOD.

By JOHN MALCOLM, F.R.C.V.S., Birmingham.

THE question of horse food and horse feeding is for the veterinarian and the horse-owner an ever-green subject, and it requires no apology for referring to a matter possessing such general interest and import-

ance, and about which, in some of its aspects, there is anything but a settled opinion.

One among these debatable points is the relative value of barley as an article of food.

No doubt the properties of barley have been the subject of considerable investigation both from a physiological and from an economic point of view, and the relative advantages and disadvantages of using barley in the form of malt, boiled barley, damped barley meal, dry crushed barley, etc., have been more or less exhaustively treated; nevertheless, there remains a very divided opinion respecting its suitability as a horse food.

For a long time I have had a growing belief that the chief point for consideration in deciding the question of using barley for feeding working horses is its relative price in comparison with other kinds of corn. A quarter of a century ago it was a common practice in many districts in Scotland to give farm horses during the winter months boiled barley for the evening meal, and wherever ordinary intelligence was observed with regard to the quantity given the practice gave satisfactory results.

Of late years, I understand, damped barley meal has come into considerable use, and is now more largely used than boiled barley, and the custom has some very strong advocates.

In referring to the use of barley for horse food, in a paper on feeding read before the Midland Veterinary Society in 1888, I stated that barley unsuitable for malting purposes, yet of good medium quality, could often be obtained at a less cost than any other feeding grain, that we had used it in the dry crushed state along with the other food, and that although it had been given in varying proportions up to one-fifth of the whole corn given, we had never seen any of the bad results, such as irritation of the bowels and skin, ascribed to it by some authorities.

Subsequently to that I discussed the question with various authorities on economic feeding, and especially with Mr Chas. Hunting of South Hetton, and the result was to corroborate and strengthen the view then expressed. As a consequence, in 1894, when the relatively low price of feeding barley made the question of its substitution for higher priced corn a subject of real economic importance, I naturally welcomed the opportunity of giving barley a more extensive trial than we had hitherto done, and my present purpose is to state as briefly as possible the result of that trial.

A section of the Birmingham Corporation stud, consisting of 120 cart horses, was selected for the experiment. These horses were all of the same class and all doing the same kind of work, and as nearly as possible the same amount of work. They were divided into two lots of sixty each, and all were weighed. One lot was fed on oats, maize, beans, and hay, and the other lot on barley, maize, beans, and hay, the daily allowance for each horse being as follows:—

Barley-fed Horses.		Oat-fed Horses.	
Hay . .	13 lbs.	Hay . .	13 lbs.
Beans . .	3 "	Beans . .	3 "
Maize . .	8 "	Maize . .	8 "
Barley . .	8 "	Oats . .	8 "

This experiment was commenced on 1st October. In a report on the subject dated 21st November, it is recorded that, although still too soon to report with any authority on the point, yet so far as could then be seen the horses on barley were doing quite as well as those on oats. The daily allowance was continued to each lot without change till 31st January 1895, when all the horses were reweighed. The result of the weighing showed that the barley-fed horses had decreased in weight an average of 28 lbs. each, whereas the oat-fed horses had only decreased 18 lbs. each. It will be remembered that the winter 1894-1895 was severe, and I may state that the general reduction in weight was attributed to the severe character of the weather and the consequent heavy work of the horses. It was decided to continue the experiment until 31st March, but owing to the general loss of weight it was resolved to increase the daily rations in each case by the addition of 1 lb. beans and 1 lb. hay. This was done, and the horses continued to receive this increased allowance till 30th March 1895, when they were again reweighed. The result was somewhat curious, and not in accordance with the previous weighing. The oat-fed horses had only recovered 3 lbs. of the previous loss, whereas the barley-fed horses had recovered 14 lbs. of the previous loss. Thus, the nett result was that on 30th March 1895 the 60 barley-fed horses were on an average 14 lbs. lighter than on 1st October 1894, while the oat-fed horses were 15 lbs. lighter. It will therefore be seen that in a stud of 120 horses, all of the same class and doing the same kind of work, 60 of which received 8 lbs. barley daily, and 60 8 lbs. oats, but whose food was otherwise precisely the same, no appreciable difference, so far as weight was concerned, could be detected between the lots after an experiment extending over six months and including severe winter weather. As with the weight, so with the general condition and staying powers of the horses no recognisable difference could be discovered between the lots. The health likewise of the one lot was equal to that of the other, nor could we perceive any difference in their skins or coats. The sole perceptible difference between the two lots was in the character of the fæces. The fæcal pellets from the barley-fed horses were not so uniform in shape nor so firm in consistence as from the oat-fed horses, but no real detriment of any kind could be recognised in connection with this, and it was particularly observed that the horses on barley were as free from colic as those on oats.

The general conclusion arrived at was that so long as good sound corn is given it is immaterial in feeding cart horses whether barley or oats is the grain used, the chief point being their relative market values. As a result of this conclusion, and owing to the cheaper relative value of barley, the whole stud of 400 horses were put on barley in place of oats on 1st April 1895, and continued to be fed in this way until 1st April 1896, and the general results were never more satisfactory than during that time.

In feeding my own horse I candidly confess I prefer oats to any other grain, partly because the fæces are less offensive than with any other corn, but while this point may counterbalance the economic one in horses kept for pleasure or personal use, it is not generally allowed, and it should not be allowed, to influence the procedure in connection with a working stud of cart horses, where the preponderating condition is efficiency with economy.

Whenever economy makes it expedient to use barley in place of oats, care should be taken to supply clean barley. Much of the barley imported contains a large percentage of dirt, and it is manifestly absurd to expect the same result from feeding with an equal weight of barley mixed with dirt as with clean oats. In one marked case in connection with a large stud in which barley has recently been condemned as horse food, the real mistake, I believe, was in giving dirty barley, and the condemnation should have been confined to the dirt and not extended to the barley.

AN ADDRESS[1] DELIVERED AT THE OPENING OF THE SECTION OF PATHOLOGY.

By A. SHERIDAN DELÉPINE, M.B., Proctor Professor of Pathology in Owen's College, Victoria University.

At the Annual Meeting of the British Medical Association in Carlisle, July 1896.

ON THE PLACE OF PATHOLOGY IN MEDICAL EDUCATION.

"*They do not deem it discreditable to desert error, though sanctioned by the highest antiquity.*"—W. HARVEY.[2]

GENTLEMEN,—We come once more, at the end of a scientific year, to bring to each other some of the fruit of our labours and help one another by friendly discussion. It is my privilege to have to welcome you, an honour which I feel too well to attempt to measure it in words. I will take advantage of this opportunity to bring before you a few considerations on some points which seem to me of actual interest to all pathologists in this country.

The tendencies of our system of medical education have for some time given rise to adverse criticism, much of which, I fear, is well founded. Quite lately the General Medical Council has had again under its consideration a motion regarding "the need for reform of the medical examination system."[3]

Pathology forms such an important part of medical science that any question touching medical education necessarily concerns teachers of pathology, who should do their utmost to make their subject useful and not a stumbling block to the medical student. This is all the more important as pathology has only of late been recognised in our universities or colleges as a subject worthy of a special chair.

To quote Professor Hamilton's words[4]—"It will, I think, be granted that the pathology of to-day is not delimitable merely as a matter of pure morbid anatomy, pathological histology, pathological physiology, pathological chemistry, or clinical medicine, but that these are simply the members of a great body, and that they are indissolubly bound together."

[1] Reprinted from the British Medical Journal, 8th August 1896.
[2] *Loc. cit.* (see end of paper).
[3] British Medical Journal, 1896, vol. i., pp. 1370 and 1397.
[4] "A Textbook of Pathology," vol. i., p. 7, London, 1886.

For over two thousand years four great branches of medicine have been more or less clearly recognised. These are now familiar to us under the names of physiology (including anatomy), pathology, hygiene, or preventive medicine, and therapeutics. I hardly need say that these branches of medicine are themselves founded on physics, chemistry, and biology. To the initiated student of disease this subdivision matters little ; the limits of his investigations are not indicated by the accident of his being either a physiologist, a pathologist, a therapeutist, or a hygienist. It is the nature of the subject investigated that should determine the scope of an investigation. Far from me the thought that anyone will ever be able to grasp all the aspects of a natural phenomenon and see it in its entirety, but I am quite certain that when we attempt to see nothing of Nature but what can be revealed by certain methods, we lose sight of many of the links which establish a connection between causes and effects. This obscuration is never so fatal as when, in addition to the limitations introduced by methods, are superadded those created by preconceived ideas or hypotheses (when these are used as permanent guides instead of as temporary helps). Hippocrates has well said—"Those who, having undertaken to speak or write about medicine, have first laid down for themselves some hypothesis to their argument, such as hot or cold, or moist or dry, or whatever else they choose (thus reducing their subject within a narrow compass, and supposing only one or two original causes of death among mankind) are all clearly mistaken in much of what they say."[1]

I have, so far, alluded only to the science of medicine; the art itself, however, does not simply consist in an application of science, but implies a knowledge of a number of social problems, and a certain *savoir faire*, and these may be used to such personal advantage as to make science of secondary importance. Dr Clifford Allbutt has alluded to this when he says:

"The merely scientific physician is apt to be blind to useful manœuvres which rest rather upon the accidental than upon the more permanent qualities of things; indeed, the practical man often sees more of the surface of things than does the analytical man, and thus keeps more of the sense called 'common.' So it comes about that, in practice, personal tact and character are as important to the operations of a physician as scientific equipment. He has to deal with men of limited vision, full of accidental qualities, and subject to accidental disturbances; and the tact which deals with these confused and conflicting attributes is born rather of a wide survey of the outside of things, and of transitory conventions, than of a penetrating insight into causation. Excessive concentration, if it fit a man for analytical study, may unfit him for the world."

"Moreover, the purely scientific physician tends to undervalue opinion, as the man of the world to overvalue it."[2]

When the only object in consideration is success in practice, as estimated by the number of patients, there can be no doubt that this argument is correct. I feel, however, that a higher ideal is offered to us by many of the older writers for whom science was a harder mistress than she is now. Over and over again Hippocrates lays stress

[1] Hippocrates, "Ancient Medicine," p. 161, Sydenham Soc., London, 1849.
[2] Clifford Allbutt, "System of Medicine," I., pp. 21, 22. London, 1896.

on the importance of scientific inquiry. "Wherefore it appears to me necessary to every physician to be skilled in nature, and to strive to know, if he would wish to perform his duties, what man is in relation to the articles of food and drink, and to his other occupations, and what are the effects of each of them on every one."[1] Galen also tells us that "It was easy, after having rapidly learned what Hippocrates had taken a long time to discover, to devote the rest of one's life to the discovery of what he has left us to find still. He who estimates riches better than virtue, and who learns his art to gather money and not for the good of humanity, cannot possibly aim at the object of medicine," etc., I feel, therefore, inclined to believe with Hippocrates and with Galen, as well as with a host of great medical masters, that the study of science is not only to be regarded as a help towards the acquirement of a respected and remunerative art, but that its prosecution is also a duty which we inherit from the moment we take advantage of the discoveries of our predecessors—a duty which we owe to our followers.

Putting aside, however, this higher standpoint, I think it is easy to prove that science has, or should have, on purely practical grounds, a place of great importance, first in the education, and afterwards in the practice, of medical men.

I have already admitted that there is much truth in the objections which have been raised against the methods of imparting scientific knowledge, and the manner in which examinations are driving the student to forsake the benefits of genuine education for the worse than useless system of "cramming." The fault of this is not in science, but in the methods of teaching or in the nature of the examinations.

The observations of Mr Teale, supported as they are by those of eminent teachers and scientists, may well be repeated here:

"The burdening of the memory with mere facts which have no direct or obvious connection with science or practice, with facts—that is, unassociated with ideas of practical utility—is on the whole of little value educationally or otherwise, and such facts make but a transient impression on the memory.

"Indeed, the examinations in each subject of professional study should be restricted to the general principles and the more important facts of the science, and should be of such a character as to induce students in their preparation for it to observe and think for themselves more than is now commonly the case."[2]

It is only when leading to excesses such as those just mentioned that scientific teaching can be objected to, and then the objection does not apply to science, but to the excess of mistaken zeal.

I do not contend the truth of the view expressed by Sydenham in his epistle to his dear friend Dr John Mapletoft when he says: "The art of medicine was to be properly learned only from its practice and its exercise."[3] All I wish to say is that though the art, at any stage of its development, can be learned at the bedside, it would remain stationary from the time no other form of research was resorted to. If we had had from the beginning no other source of information our knowledge of medicine would have remained entirely empirical and

[1] Hippocrates, *loc. cit.*, p. 175.
[2] T. Pridgin Teale, British Medical Journal, i, p. 1371.
[3] "Observationes Medicæ," 1685. Sydenham Society, vol. i., p. 4. London, 1848.

without any other foundation than misunderstood facts revealed by hazard and practices built upon rash and often cruel experiments on the sick.

The conditions of life are so complicated, especially in the case of the civilised man, that a mere superficial examination of natural phenomena, by means of our unaided senses, would seldom have led to more than rough guesses regarding the causation of disease. If this be doubted, let it be remembered that it is not many years since there was a general belief in the production of frogs out of mud, of maggots out of flesh, of micro-organisms out of infusions, and that even in this century it was only by very carefully planned experiments that it has been proved that life, as it is known to us, is invariably a continuation of pre-existing life.

The difficulty with which the nature of things can be apprehended might encourage scepticism and lead to a want of confidence in the use of science. I think this kind of doubt has been justly deprecated by Claude Bernard, when he says: "The sceptic is one who does not believe in science, but has confidence in himself; he believes enough in himself to deny science and to affirm that it is not governed by fixed and definite laws. The doubter is the true scientist; his only doubts are about himself and his own interpretations, but he believes in science; he admits that even in experimental science there is a criterion or absolute scientific principle. This principle is the 'determinism'[1] of phenomena which is absolute as well in the phenomena occurring in living organisms as in those taking place in non-living bodies."[2]

I think that such an attitude of mind should simply induce us to be modest in our conclusions, but should not deter us from studying the relations of phenomena occurring under our eyes and tracing these relations as far back as the possibilities of accurate observation and reasoning will allow. Primary causes may be left to the speculation of philosophers, and we should be careful not to fall into the errors of certain Greek medical schools, which, having the substance of the sound Hippocratic teachings, ran after the shadow of vain speculations regarding the ultimate nature of things.

Though some clinicians may sneer at the pretensions of science, they do, and must, as a matter of fact, constantly make use of results obtained by scientific workers. Whether they do so as a result of conviction or for appearance's sake does not matter, for, in any case, they obtain the benefit which they look for.

They often use tests for sugar, albumen, blood, or bile in the urine; elastic tissue or tubercle bacilli in the sputa; various parasites in the skin; they may even look for worms or protozoa in the blood; they will not scruple about recommending the use of anæsthesia, of vaccination, of antidiphtheritic serum, of antiseptic or aseptic dressings, of boiling of milk, of disinfection of rooms. They will know how to stop arterial and venous hæmorrhage; they may prescribe such drugs as morphine, pepsin, nitrite of amyl, and take advantage of the ophthalmoscope, to say nothing of the *x* rays, and so on.

1 By this word must be understood in physical science the invariable relation existing between cause and effect.

2 Claude Bernard, "Introduction à l'Etude de la Médecine Expérimentale (De l'Idée a priori et du doute)," p. 91 (Paris, 1865).

Where have the ideas which have led to the elaboration of these methods been worked out? At the bedside? No. The observation of patients at the bedside undoubtedly creates the desire to relieve suffering, and this desire urges the observer to ascertain exactly the nature and the causes of suffering and to find out the methods of treatment which will be most suitable for its relief. But it does not give the means of satisfying this natural desire, and deeper investigation is necessary in order to discover the essential effects of disease and of the ways of dealing with them. If this be doubted, I will simply refer to the names of Harvey, Jenner, Bright, Addison, Bennett, Paget, Virchow, Claude Bernard, Ludwig, Burdon Sanderson, Helmholtz, Marey, Pasteur, Lister, Villemin, Koch, Laveran, Lauder Brunton, to mention but a few. But, it will be said, more than half of these men were or are clinicians. This is true, and I have purposely selected their names to show that a clinician may also be a scientific man. Moreover—and this is an important point —these clinicians never trusted entirely to simple clinical observation, and I make bold to say that in most cases their discoveries were both prompted and tested by accurate scientific observation.

The scientific clinician is in a better position than any other observer to discover groups of symptoms indicating special diseased states. This is easily proved by the large number of diseases or symptoms to which the names of celebrated practitioners have remained connected—Pott, Dupuytren, Graves, Addison, Hodgkin, Erb, Friedreich, Duchenne, Charcot, etc. In the laboratory such opportunities do not occur, but principles which are used as bases of investigation are worked out, and nobody could say that such men as Harvey, Hunter, Goodsir, Waller, Wilks, Lister, Claude Bernard, Pasteur, Chauveau, Ranvier, Helmholtz, Du Bois Reymond, Ludwig, Virchow, Cohnheim, Koch, and others, have not done much for the advancement of medicine.

I think it is unnecessary to pursue this argument further, for I consider I have said enough to justify the opinion that scientific training is useful to the medical man. I feel also justified in saying that the bedside is not the place for prosecuting researches which might involve danger, or even serious discomfort to the patient on no other ground than mere fancy. As pathology concerns us more specially here than the other great branches of medicine, I will now confine my remarks to it. Let us first consider how the subject is taught in schools.

1. Under the name of clinical medicine, that part of pathology which deals with symptoms, diagnosis, prognosis is taught at the bedside with applied therapeutics.

2. The same subjects are also usually dealt with in systematic lectures on medicine and surgery, lectures which are also very often made to cover a considerable portion of other branches of pathology.

3. Pathological anatomy is taught in systematic lectures and demonstrations, and practically in the *post-mortem* room.

4. Pathological chemistry and histology are taught by means of lectures and demonstrations, and of practical classes.

5. Etiology and pathogenesis are taught by means of lectures, which are sometimes complemented by a practical course in bacteriology.

6. Experimental pathology is reserved for advanced students, and does not form a regular part of any curriculum.

If all these subjects were taught by the same man, he would certainly not require to say in systematic lectures what he had already clearly explained at the bedside, or in the *post-mortem* room, or in the laboratory; he would as much as possible try to save his own time as well as that of his pupils by not repeating himself. He would reserve for lectures those subjects that cannot be easily and better taught by actual demonstration.

Is it possible for three or four men teaching the various branches of the same subject so to combine their efforts as to give students the benefit of advantages which they would derive from being taught by a single man? I believe that, within certain limits, such a thing is possible on condition that the following principles be kept in mind by all teachers:—

1. Every fact capable of simple actual demonstration should be taught by means of demonstration whenever this method does not involve excessive loss of time, considerable expense, wanton cruelty, or a knowledge of methods unknown to the student.

2. In each department the teacher should, as much as is compatible with clearness, confine his teaching to the demonstration and exposition of those facts which fall within the natural sphere and the actual work of his department.

It may be said that a teacher of, say gynæcology may be a better authority on bacteriology than the colleague who has charge of that department. I select on purpose the most unlikely accident. Would this justify the teacher of gynæcology in lecturing on bacteriology? Certainly not, for the student would in the end be the loser; his time spent in the bacteriological department would be wasted, and in the gynæcological department his opportunities of learning gynæcology would be diminished.

The morbid anatomist, who, giving a demonstration on carcinoma of the rectum, would lecture at length on the symptoms of intestinal obstruction, instead of attracting the attention of the student to the anatomical lesions found in such cases, would cause the student a serious loss of time; for there are better opportunities offered to him in the wards for learning by personal experience under the direction of competent clinical teachers the symptoms in question.

In the same way it would be a serious mistake on the part of the clinical teacher to devote the greater part of a clinical lecture on tuberculosis to a detailed account of the various methods used for cultivating and for staining the tubercle bacillus. His duty does not go beyond showing the application of some of these methods in practice, and the more time he gives to the description of the symptoms which he can show to the student, to the methods of diagnosis and treatment, and to the course of disease during life, the more the student will benefit from his teaching and use his time profitably.

3. It seems to me also important that the time devoted to the study of each branch of medicine should be proportional to the relative importance of the facts and principles taught rather than to the number of details which have erroneously been thought to be necessary elements of certain studies. And in determining the

relative value of scientific courses from an educational point of view, I would feel inclined to give the preference to those in which it is possible to make the student see and judge for himself. Lectures should be reduced to the smallest number compatible with a clear exposition of those principles which would otherwise have to be constantly repeated in the course of practical demonstrations, or to those subjects which are not capable of demonstration at all.

Long discourses on purely hypothetical matters are, however, of little use to the student, for they foster in his mind the habit of doubting the value of scientific work at a time when he is not able to judge of the value of arguments. I am quite prepared to hear that such an attempt to deprive education of much of what is speculative in science would lead to a loss of fertilising influence which would more than compensate for the advantages gained. To this I would answer that it is more by explaining to the beginner the subjects where speculation has given good results than by teaching him doubtful hypotheses that have borne no fruit that the proper methods of observation and reasoning will be impressed upon him. For the same reason I doubt whether up-to-date teaching, when pushed to the excess it is sometimes, confers a lasting benefit on the student. In his anxiety to give out the latest information the teacher is often exposed to speak of things which he has hardly been able to grasp fully himself, and which in most cases he has not been able to observe.

Having now explained to you in a general way my reasons for holding certain views regarding the teaching of medical science, I wish to submit to you certain suggestions regarding the teaching of pathology, and, if time permits, I hope some time will be found at the end of one of our meetings for a discussion of this question. I may say at once that what I consider true with regard to teaching seems to me equally true with reference to examinations, for teaching, properly conducted, should provide the information wanted by the student in order that he may prove a good and successful worker during his professional career, and examinations have no other object than to find out whether this result has been attained. They should give the means of testing whether a man is capable of using in practice the knowledge which he has acquired.

It will simplify matters if, in order to give a more concrete form to my ideas, I ask you to suppose that we follow a student desirous to gain personal experience in his study of cases surgical or medical.

1. In the wards of the hospital he is shown how to recognise the presence of certain symptoms, and from this to establish a diagnosis; he then sees various modes of treatment, surgical or medical, applied, and is made to note the course of events that follow, being thus initiated to the art of prognosis. Here the only means he has to test the accuracy of the views expressed to him by his teachers are the effects of treatment and the correctness of the prognosis.

2. In the *post-mortem* room he has an opportunity to see for himself what gross lesions correspond to some of the symptoms to which his attention has been attracted during life. The meaning of the appearances due to alteration of size, shape, colour, etc., have to be explained to him as far as it is safe to do so from a naked-eye examination. The teaching in the *post-mortem* room cannot go further, and is necessarily fragmentary.

3. It must therefore be supplemented by demonstrations of museum specimens by which complete series of lesions, some of which occur rarely in the *post-mortem* room, can be made to illustrate the coarse anatomical changes produced in the body by disease. Such specimens being provided with short clinical histories, there should be as little room for speculation as possible regarding the nature of the symptoms associated with the lesions. This general study of morbid anatomy is specially useful in directing the mind to the parts of the body which are most generally affected by disease, and to the way in which certain symptoms are mechanically produced. Naked-eye anatomy, however, gives very little information regarding the nature of the reactions of the organism to morbific agents; it seldom gives the means of finding the actual cause[1] of diseases, and it must be admitted that many of the naked-eye appearances are so ambiguous that even an experienced morbid anatomist is often mistaken as to the meaning of lesions observed in the *post-mortem* room or in the museum.

4. In the histological laboratory the student sees the changes of structure which give rise to the appearances observed in the *post-mortem* room, and here he begins to be on firmer ground and better able to acquire a knowledge which will depend less on an extensive practical experience than on well-trained powers of observation. The reasons for this are: (1) that all the organs of the body are composed of a few elementary tissues; (2) that these tissues are composed of cells which have many properties in common; (3) that the morphological changes indicating the reaction of these cells to pathogenic agents are comparatively few. It is, therefore, possible for a teacher to impart within a limited space of time and by means of actual demonstrations a tolerably complete and accurate notion of the anatomical changes produced in the organism by disease. It is owing to these advantages, and not to any special fancy for microscopical work, that pathological histology has taken such a leading part in the study of disease.

If all the morbific agents produced essentially different reactions in the cells, cellular pathology would give infallible indications by means of which diseases could be accurately separated from each other. Unfortunately this is not always the case; but even after this admission I feel quite justified in asserting the primary importance of morbid histology.

Pathological chemistry, though growing rapidly in importance, is still too speculative to be placed on the same level as morbid histology from an educational point of view, and as nearly all the chemical methods used in the investigation of disease are similar to those taught in courses of physiological chemistry, it seems to me that, at the present time, the laboratory of pathological chemistry should be reserved for advanced workers prosecuting investigations rather than for the purpose of systematic teaching. This question, however, has to be determined in each school by the provisions which have been made for the teaching of physiological chemistry.

5. We now come to the most difficult part of pathology. So far we have had to deal only with the objective parts of the subject, with facts which necessitated chiefly powers of accurate observation, and

[1] I use the word cause in a very limited sense; as, for instance, applying to a pathogenic bacterium, a poison, etc.

which could all be easily demonstrated. When we come to deal with causes of disease and with the way in which lesions are produced we must necessarily introduce into our work induction, deduction, and experimentation. When a number of facts seem to indicate that two or more phenomena are correlated and due to the action of a certain cause, we feel generally, when dealing with biological problems, that we may have overlooked many factors, and therefore we have to test our views by experimentation. Experimentation is not, however, always guided by direct observation, for it often happens that the causation of certain lesions is inferred from what we know of the causation of other more or less analogous lesions.

The nature, the duration, and the difficulty of many of the experiments which have been made for the purpose of testing theories touching the causation of disease and the production of lesions make it difficult to teach the whole of this part of pathology by means of demonstrations and practical classes, and it is in this case that systematic lectures and textbooks are the most justifiable and, in fact, necessary.

Etiology and pathogenesis cannot be put aside, for much of the advances which have been made in the art of prognosis, in the treatment, and in the prevention of disease are based on our improved knowledge of these subjects.

Bacteriology, however, lends itself specially well to practical work, and I believe it would be beneficial to most medical men to have a more practical knowledge of this subject than they are generally made to acquire in the course of their studies.

The conclusion which I draw from all these considerations is that students would obtain a more useful knowledge of medicine if they had fewer lectures and more practical courses. They should be made to attend thorough practical courses on (1) pathological anatomy, histology, and chemistry; (2) bacteriology as applied to the study of infectious diseases; (3) general clinical medicine and surgery, with special courses in special branches of clinical work such as diseases of women and obstetrics, diseases of children, infectious diseases, mental diseases, diseases of the eye, of the ear, of the throat, etc.

Systematic lectures should be confined to courses on (1) etiology of disease and pathogenesis; (2) general considerations regarding the practice of medicine and of surgery. These courses should be as short as is compatible with a clear exposition of those principles, which but very few students would be able to formulate for themselves from the study of facts.

Finally, I wish to say that if, in expressing my views, I have wounded the feelings of any who have opinions differing from mine, I will ask him to apply to me the words of Harvey: "I would not charge with wilful falsehood anyone who was sincerely anxious for truth, nor lay to anyone's door as a crime that he had fallen into error." [1]

[1] Harvey, "An Anatomical Dissertation upon the Movement of the Heart and Blood in Animals." Dedication 1628. Rendered into English for G. Moreton, Canterbury. 1894.

EDITORIAL ARTICLES.

PLEURO-PNEUMONIA.

Now that pleuro-pneumonia is an extinct disease with us, a British veterinary surgeon can hardly be expected to follow investigations and discussions regarding its etiology with as much interest as when it was still prevalent among our own cattle. At the same time, probably few of us are so indifferent as not to have felt some interest with regard to the alleged discovery of the cause of the disease by Professor Arloing, the Director of the Lyons Veterinary College. It was with a view to placing our readers in a position to judge as to the completeness of the evidence on which the claim to the discovery was based, that we published in the Journal for last year a translation of a long report which M. Arloing had furnished to the French Minister of Agriculture on the so-called pneumo-bacillus, and its product—pneumo-bacillin.

Thanks to the diffusion of knowledge regarding the elementary principles of bacteriology, every well-informed medical man or veterinary surgeon now knows what are the steps necessary to prove that a particular germ is the cause of a certain disease, and is quite capable of detecting the absence of a link in the necessary chain of evidence. (1) The germ must be of constant occurrence in the bodies of animals suffering from the disease of which it is alleged to be the cause, and its presence there must be capable of demonstration either by direct observation with the microscope, or by cultivation methods; (2) with cultures of assured purity it must be possible to produce the disease experimentally. These are the essential steps in any investigation intended to causally connect an organism and a disease, and it is on the ground of such evidence that we accept the anthrax bacillus, the glanders bacillus, and the tubercle bacillus as severally the cause of the diseases with which we associate them by name. Judged in that way, did Professor Arloing's researches prove that the organism which he named the pneumo-bacillus is the cause of pleuro-pneumonia? The answer to that must assuredly be in the negative.

Professor Arloing was not the first to attempt to isolate the germ of bovine pleuro-pneumonia. Even Pasteur himself had previously made the attempt, and had satisfied himself that pleuro-pneumonia lymph, although we know from its effects that it must contain the actual virus of the disease, behaved to ordinary bacteriological methods like a germ-free fluid, that is to say, when taken with precautions sufficient to prevent accidental contamination, it showed no bacteria on microscopic examination, and it failed to fertilise any of the ordinary media used for the artificial cultivation of organisms.

Although the published researches on the subject are not numerous, there is probably not a veterinary bacteriologist in Europe who has not endeavoured to isolate the germ of this disease, and the silence of the great majority of them is simply ascribable to the non-success of their efforts in this direction. When, therefore, M. Arloing came forward with the announcement that he had discovered the germ of pleuro-pneumonia, one naturally expected to find that his success, where many competent workers had previously failed, was attributable to the employment of some new method in the research. In a sense this expectation was fulfilled, for it transpired that in his first attempts to cultivate an organism from pleuro-pneumonia lymph M. Arloing had been no more successful than M. Pasteur, but as soon as he began to import a certain modification into his methods he obtained positive results. But the very nature of this modification was such as to throw serious doubts on the value of the results obtained under it. It consisted in employing a *large quantity* of the lymph to inoculate the culture media. Bouillon flasks inoculated with small quantities of the lymph generally remained sterile, but when several drops of the lymph were used a growth was often obtained. Sometimes, however, a flask inoculated with five drops remained sterile, while another inoculated with two drops became crowded with bacteria. The turbid liquid from the centre of an area of hepatisation was always richer in bacteria than the transparent serosity from the interlobular or sub-pleural spaces. Cultures were obtainable even from the warm lung, but the bacteria appeared to be more abundant in lungs that had been allowed to cool.

Now it hardly needs to be pointed out that in inoculating media from any sort of inflammatory lesion in the lung, one runs some risk of obtaining cultures of accidental organisms that have penetrated with the inspired air, and of course the risk increases with the quantity of material used to inoculate each flask or tube, and with the time that has elapsed since the animal's death. When M. Arloing, like previous observers, found that even five drops of lymph from the interlobular spaces of a pleuro-pneumonia lesion might fail to start any growth in a flask of bouillon, he would have done well to set down his occasional success with much smaller quantities to the accidental presence of some extraneous organism.

However, it must not be supposed that M. Arloing based his assertion that this liquefying bacillus was the cause of pleuro-pneumonia solely on the results just referred to. It is true that he at first admitted his inability to reproduce exactly the natural disease with his artificial cultures, but he relied upon a series of what he regarded as secondary proofs. These proofs were drawn from the constant presence of the pneumo-bacillus in the pulmonary lesions, from its constant and exclusive presence in the metastatic joint accidents sometimes seen after subcutaneous inoculation with pleuro-pneumonia lymph, and from the identity of the physiological effects of his arti-

ficial bouillon cultures and filtered lymph from a pleuro-pneumonia lesion—an identity which extended to the production of a diagnostic reaction in animals affected with pleuro-pneumonia, and, in the case of healthy animals, an immunity against a future attack of the disease. Subsequently he announced that he had "produced in the ox with pure cultures of the pneumo-bacillus between the second and the tenth generations, not indifferent inflammatory lesions or transitory œdema, but the typical alterations which the virus of contagious pleuro-pneumonia can cause under the skin and in the chest."

With such an array of evidence as this it appeared to M. Arloing unreasonable to demand any further proof, but still some of the most distinguished of his own compatriots remained unconvinced or absolutely sceptical ; and M. Nocard suggested that all doubts might be removed by placing an animal in which M. Arloing had set up an experimental pulmonary lesion by injection of the pneumo-bacillus in the middle of a number of healthy animals, and observing whether the latter became infected by contact. Most people will agree that this seemed a fair way of ascertaining whether the pneumo-bacillus was the cause of the disease or not, but M. Arloing objected to it on the ground that "although it would be simple to carry out, its results would be very uncertain," seeing that "every healthy animal put in contact with a pleuro-pneumonic animal does not certainly take pleuro-pneumonia." It was also suggested that the specific nature of M. Arloing's bacillus might be tested by an experiment in which a number of cows affected with pleuro-pneumonia would be introduced into a stock divided into three lots, namely, one lot of cows left untouched, one lot inoculated with natural pleuro-pneumonia lymph, according to the Willems' method, and a third lot inoculated with a culture of the pneumo-bacillus. If the experiment showed that inoculation with the "culture" conferred immunity, that would prove the specific nature of the pneumo-bacillus. Strange to say—strange, that is, on the assumption that he had confidence in the bacillus which he had put forward as the cause of pleuro-pneumonia—M. Arloing shrank from this test, which, "after mature examination, he did not find indispensable." He thought that such an experiment, to yield conclusive results, would require to be on a large scale, and he preferred to abide by the opinion of veterinary surgeons and dairymen who had observed the advantages of inoculation with cultures of the pneumo-bacillus in the byres of Paris. The French law prescribes compulsory inoculation of the "in contact" but apparently healthy animals in every outbreak of pleuro-pneumonia, but as it does not specify how the inoculation was to be carried out, the Department of Agriculture did not object to the operation being performed with M. Arloing's culture instead of with virus from a diseased lung. The results were declared to be exceedingly satisfactory—indeed slightly superior to the old method in respect of the degree of immunity conferred, and decidedly

superior in the sense that the operation was perfectly free from the risk that always attends inoculation with natural lymph. The culture inoculations were received with so much favour by the dairymen that they bade fair to entirely replace the old method. All this seems very comical in view of some recent experiments, whose results must now be stated.

Fortunately, the experiment which M. Arloing thought "not indispensable" was, after all, carried out. A sufficient sum of money having been subscribed for the purpose by the Department of Agriculture and a number of agricultural and veterinary societies, a committee of supervision was appointed, and the experiment was begun in January of the present year at a place called Pouilly-le-Fort. Forty cattle, purchased in a district free from pleuro-pneumonia, were divided into three lots, as uniform as possible in respect of age and sex. One lot of thirteen was inoculated by the Willems' method (with natural lymph); a second lot, also comprising thirteen animals, was inoculated according to the new Arloing method (with artificial culture of the pneumo-bacillus); and a third lot, comprising the remaining fourteen animals, was left uninoculated to serve as a control. Five weeks later two cows suffering from pleuro-pneumonia were introduced into the experimental herd, and allowed to associate freely with the members of it for fourteen days. During this period one of the thirteen animals inoculated by the Willems' method died. The remaining thirty-nine cattle were kept under close observation, and between four and five weeks after the introduction of the two diseased cows symptoms of pleuro-pneumonia began to develop in some of the animals inoculated by the Arloing method and also in a few of the control lot (uninoculated). On the 9th of May all the animals not previously killed on account of the gravity of the symptoms were slaughtered. The final result of the experiment was as follows:—Not one of the twelve subjects inoculated by the Willems' method showed any trace of pleuro-pneumonia; nine out of the thirteen inoculated by the Arloing method were affected with pleuro-pneumonia; and ten out of the fourteen control subjects were similarly affected. In short, the Arloing method, as a means of conferring immunity against pleuro-pneumonia, was proved by the experiment to be an absolute failure.

M. Arloing, however, appears to cling with desperate tenacity to the belief that his bacillus is the specific germ of pleuro-pneumonia, for in commenting upon the results of the above experiment he refuses to see in them a proof that the pneumo-bacillus "had not exercised any influence on the receptivity of the animals, and that therefore it has nothing to do with the production of pleuro-pneumonia." He has to admit that the proportion of animals attacked among those inoculated by his method was practically the same as among the control lot, but he contends that

the course of the disease was less acute in the former than in the latter, and in this he sees some evidence of the specific nature of his bacillus. Professor Arloing is evidently one who can extract a crumb of comfort from the most desperate circumstances, but his resources in this direction and his ingenuity in argument will be still more severely strained by some experiments more recent than those just referred to. M. Lignières, working in Professor Nocard's laboratory, has confirmed M. Arloing's statement with regard to the frequent presence of the pneumo-bacillus in the lungs of cattle affected with pleuro-pneumonia, but he has also found that it is *habitually present in the lungs of healthy cattle.* When it is added that the correctness of these statements has been verified by M. Nocard, the last word has evidently been said on the claims of the bacillus liquefaciens bovis to be regarded as the germ of pleuro-pneumonia.

But if the recent experiments at Pouilly-le-Fort proved that the pneumo-bacillus inoculations had no protective effect, they no less clearly demonstrated that the Willems' method of inoculation confers a high degree of immunity against pleuro-pneumonia. It may safely be predicted that we have not heard the last of that operation as a means of combating the disease. The advocates of inoculation are sure to find in the Pouilly-le-Fort experiments a new justification for that practice, and we observe that the Sixth International Veterinary Congress is already being taunted with having overlooked the claims of inoculation as a means of suppressing pleuro-pneumonia. The truth is, however, that the Sixth International Veterinary Congress refused to say anything in favour of the Willemsian inoculation, not because they doubted its efficacy in such conditions as those of the Pouilly-le-Fort experiments, but because, after many years of trial on a large scale in France, Holland, and other countries, it had signally failed to exterminate the disease. On the other hand, the Congress had before it information to show that every country that had discarded inoculation in favour of the system of general slaughter of diseased and suspected had succeeded in stamping out the disease, and by force of evidence the Congress had therefore to declare that the latter system was the sovereign method of dealing with pleuro-pneumonia.

In the Pouilly-le-Fort experiments the Willems' method of inoculation was practised on animals known to be free from pleuro-pneumonia, and the sequel showed that the operation had conferred a high degree of immunity in them. But these are not the conditions in which the operation has to be performed in actual practice. There the animals that have to be inoculated are those that have already been exposed to infection, and in nearly every case that means that some of them have already contracted the disease. Upon such animals inoculation exerts neither protective nor curative influence, but it lulls the owner into a false feeling of security, and thereby contributes to the spread of the disease.

The experiment which does throw light on the value of inoculation in the conditions under which it would have to be practised as a means of checking the disease, is the one which was carried out at M. Arloing's instigation in the affected byres of Paris. There the Willemsian method was tested against inoculations with cultures of the pneumo-bacillus, with the result that the veterinary surgeons and the owners of the cows actually pronounced in favour of the latter method. And yet, in view of the results of the later experiment at Pouilly-le-Fort, distilled water might have been substituted for M. Arloing's culture fluid without any difference in the effects. Let us be thankful that in Great Britain we resolved to have nothing to do with inoculation, and to pin our faith to the policy of general slaughter.

PNEUMONIA IN SWINE-FEVER.

AT the recent annual meeting of the National Veterinary Association, held in Yarmouth, the principal subject of discussion was swine-fever, and one of the points that received a good deal of attention in the debate was the frequency of pulmonary lesions in that disease. In the paper which served to introduce the subject for discussion it was stated that "the only lesions that are frequently encountered in the lungs of pigs that have died or been killed while suffering from swine-fever are small hæmorrhages and collapse. . . . Actual pneumonia, whether catarrhal or croupous, is a rare lesion in swine-fever, and it is very probable that it is generally, if not always, a complication of the disease, and not caused by the swine-fever bacillus. This view did appear to be in harmony with the experience of most of those who took part in the discussion. Mr Clement Stephenson of Newcastle, who was the first speaker in the debate, thought that lesions of the lungs, pleura, and pericardium, were at one time exceedingly common in swine-fever, and in his experience such cases are still met with, though not so frequently as formerly. Several subsequent speakers declared that their experience with regard to lung lesions had been similar to that of Mr Stephenson, and some went a good deal further, and avowed that in practice they still attach much diagnostic importance to cough and other signs of chest affection.

Now, this difference of opinion regarding such a very common disease as swine-fever is certainly remarkable, and it ought to be possible to put an end to it, The statement that pneumonia is rare in this disease was based partly on a large series of experiments carried out at the Royal Veterinary College in 1895 for the departmental committee on swine-fever. In these experiments some of the pigs were infected by contact with others already diseased, others by mixing infective material, such as artificial culture or pieces of ulcerated bowel, with their food, and a few by subcutaneous inoculation. Setting

aside these latter cases, which formed only a small proportion of the whole, it may be said that the mode of infection in the experimental cases approached to the way in which the disease is naturally contracted. If, as probably everyone is ready to admit, the common method of natural infection is the ingestion of food materials accidentally soiled with fæces containing swine-fever bacilli, then we should not expect to find any variation in the type of the disease or the seat of the lesions because a pig had been infected by means of swine-fever bacilli intentionally mixed with its food. Nor was there any other circumstance in connection with these experimental pigs that could reasonably be held to give them exemption from pneumonia, if that is of common occurrence in natural cases of swine-fever; and yet, as has already been said, not one of the pigs had the smallest patch of pneumonia. Perhaps it is also worth while to add that the pigs were not by any means all at an early stage of the disease when they were submitted to *post-mortem* examination. In most cases the disease had actually terminated fatally, or the animal appeared moribund at the time when it was killed.

But the statement that pneumonia is very rare in swine-fever appeared to have equally strong justification in another direction, for the officers of the Board of Agriculture assert that among the thousands of specimens passing through their hands it is quite exceptional to find hepatisation of the lung associated with distinct swine-fever lesions in the bowel. It seems to be impossible to reconcile this experience with a belief that pneumonia is at all common in swine-fever. It is hardly necessary to say that the occurrence of pneumonic lesions in association with unmistakable swine-fever lesions in the intestine is not denied. To do that would be equivalent to asserting that the onset of swine-fever gives a pig immunity from pneumonia of any kind, or that a pig suffering from pneumonia cannot be infected with swine-fever. It is admitted that genuine pneumonia and hepatisation are sometimes met with in cases of swine-fever, but in view of the experience of the Board of Agriculture we adhere to the statement that the combination is rare. The experience of no single individual would suffice to controvert that assertion.

There is, however, one point still unsettled, and that is whether pneumonia when it does occur in the course of swine-fever is generally a complication, or an effect of the swine-fever germ. It ought to be possible to bring any conflict of opinion on this point to an end. Now that the causal organism of swine-fever can be readily identified in artificial culture, the question might be settled by a bacteriological examination of pneumonic lesions found in co-existence with swine-fever ulcers in the bowel. To find the germs of swine-fever constantly present in pure culture, or greatly in excess of any other organism, in the hepatised areas

would be strong evidence that these lesions are as much the effect of the swine-fever bacillus as the bowel ulcers. On the other hand, the absence of swine-fever bacilli from the *fresh* lesions, or the presence of another organism in great numbers, would indicate that the swine-fever germ is not responsible for such lesions, and that pneumonia occurring in the course of swine-fever is an accident, due to the propagation of some second organism in the lung tissue.

Now that the cold season is coming on, when it will be possible to insure the arrival of specimens in a fairly fresh condition, we shall be glad if those who encounter lesions of pneumonia in the pig will forward the lungs to us in order that a bacteriological examination of them may be made. And we may add that we should be glad to receive such lungs although the pneumonia is not associated with bowel ulceration, or with anything else to indicate that the case is one of swine-fever, as in this way evidence for or against the occurrence of an infectious pneumonia (German swine plague) among British pigs might be accumulated.

THE BUTCHER AS MEAT INSPECTOR.

"THE best inspector of cattle and meat is a well-educated butcher of long training." Such, according to a report of the proceedings of the Sanitary Institute [1] is the opinion of Dr Marsden, Medical Officer of Health for Birkenhead. For the credit of Medical Officers of Health in general we should be glad to suppose that the report is incorrect; but, unfortunately, it is in substantial agreement with the report of Dr Marsden's remarks which appeared in several other papers, and so far as we know no disclaimer has been published.

Let none of our readers suppose that we are going to insult their intelligence by an elaborate refutation of this astounding proposition. If a veterinary surgeon had said that a well-educated barber of long training makes the best medical man, we may be sure that no medical journal would have thought it worth while to formulate reasons for coming to an opposite conclusion. And therefore we content ourselves with reproducing this curious opinion here, as an example of the strange ignorance which still exists in some quarters regarding the scope of meat inspection.

In a recent number of the Journal (December 1895) we took occasion to refer to the subject of meat inspection, and in particular to the relative fitness of medical men and veterinary surgeons to discharge this duty. Reflections on that point were provoked by a report of a discussion in the Public Health Section of the British Medical Association at the annual meeting of that body in 1895.

[1] British Medical Journal, 12th September 1896.

In that report Dr Legge was said to have made some statements which bore the interpretation that he did not consider British veterinary surgeons well qualified to act as meat inspectors, and that he would prefer to see that work left to medical men. From that view of the subject we strongly dissented, and gave reasons for maintaining that if we are to have an efficient system of meat inspection in this country the work must be left to qualified veterinary surgeons. We return to this subject here because we find that in the article referred to we did Dr Legge an injustice in ascribing to him the views above stated. From a fuller report which appeared in the *Lancet*, and which had escaped our notice, we learn that Dr Legge advocated the appointment of "professional meat inspectors, preferably from the ranks of veterinary surgeons, to replace the untrained persons at present charged with the work. He would prefer to leave to the veterinary-inspector-in-chief the final decision as to what meat should be condemned or not, rather than to the medical officer of health and a justice."

We regret that we were led to attribute to Dr Legge opinions almost diametrically opposed to those which he had really expressed, and we gladly take this opportunity to correct the error.

THE DANGERS OF TUBERCULIN.

We observe that some of the agricultural journals have been cautioning their readers against the dangers which attend the use of tuberculin as a test for tuberculosis in cattle. The nature of these dangers is not exactly defined, but it is hinted at by the use of the word "poison." But strange to say, although tuberculin is now in daily use in every country in Europe, no case of poisoning by it has yet been recorded. The apprehensions as to its evil effects appear to be confined to those who have had no experience of it. Everyone knows that its diagnostic value depends upon the reaction which it provokes in animals that are the subjects of tuberculosis, but this reaction is very transient, and never such as to endanger the animal's life. Thousands of observations warrant us in assuring stock-owners that tuberculin in the dose necessary to bring out its diagnostic effects is absolutely harmless to a healthy cow; and although a short febrile attack follows its injection into tuberculous individuals, it certainly does not aggravate the disease, and very possibly ameliorates it.

If any caution with regard to the use of tuberculin is necessary, it is in the direction of warning owners of tuberculous herds not to delay the test until Government forces it on them, and compels the slaughter of their diseased animals, with compensation that they will consider very inadequate.

Review.

Median Neurotomy in the Treatment of Chronic Tendinitis and Periostitis of the Fetlock. By C. Pellerin. Translated, with additional facts relating to it, by Professor A. Liautard, M.D., V.M. New York: William R. Jenkins, 1896.

THIS is a translation of two articles on the subject of median neurotomy, the first by M. Pellerin, and the second by M. Sendrail, both French veterinary surgeons. M. Pellerin's monograph extends to fifty-five pages, in which he describes the history of the operation, the indications for its performance, the method of performing it, and his own experience with regard to it in twenty cases. In eleven of these cases the disease for the relief of which the operation was performed was chronic tendinitis, and in all of these recovery followed; in five of the cases tendinitis was associated with disease of the fetlock, and in each of these improvement followed the operation; in three cases of periostosis of the fetlock two were classed as recoveries and one as a failure; and, lastly, a failure was the result in one case of ringbone. It may be of interest to compare these results with those obtained by Professor Hobday in the larger series of cases recorded in this number.

The second article extends to only six pages, and gives M. Sendrail's experience of the operation, of which he expresses a favourable opinion.

CLINICAL ARTICLES.

SOME CASES OF MALIGNANT TUMOURS IN THE HORSE AND DOG.

By E. E. MARTIN, Veterinary-Lieutenant, Army Veterinary Department, Barrackpore.

IN a very interesting article which appeared in several numbers of *The Journal of Comparative Anatomy and Therapeutics*, for 1890 and 1891, the editor furnished a valuable contribution on "The Occurrence of Tumours in the Domesticated Animals." The contributions consisted essentially of a histological report on numerous tumours sent to him by practitioners, and we are enabled by it to get a very fair idea of the frequency of the occurrence of different varieties and the histological peculiarities they present. With a few exceptions, however, there was not much in the way of clinical history of the cases given.

I have come across several cases of malignant growths lately in which operation for removal has been attempted and the nature of the growths verified by microscopical examination. I think the results may prove interesting, and have therefore penned the following notes on these cases.

CARCINOMA.

White polo pony, mare, aged, the property of an officer in the 19th Bengal Lancers.

The mare was sent to the hospital on the 11th November 1895, said to be suffering from a sore just below the anus ; this had been present for three months, but owing to the owner having been away for the past two months he had taken no professional advice. The mare was very fidgety and had to be thrown to be examined. It was found that the so-called sore was a firm growth situated between the anus and vulva, extending inwardly, and in close proximity to the rectum superiorly and the vagina inferiorly. Superficially it was ulcerating.

Our advice to the owner was immediate and radical removal. Accordingly, two days later she was thrown and anæsthetised, and the tumour was dissected out. It was intimately connected with the rectum and the vagina, so considerable care had to be exercised to prevent incising either. After it had been dissected out and a few small vessels ligatured, the wound was loosely sutured and dressed.

Previous to operation she had been physicked and kept without food for forty-eight hours, and after the operation nothing was given for two days, and then for several days only two pounds of bran were given in a sloppy mash, the object being to keep her empty and to keep the rectum and anus as quiet as possible.

For some time the wound did well, then the edges were found to be indurated, and on the 11th December she was cast and the hardened edges removed.

The wound still refused to close, and on the 28th January she was again cast and an examination made. The edges were indurated, and above the anus on either side beneath the skin two hard irregular swellings, about the size of a pigeon's egg, were felt.

The mare was a very fine polo pony, and the owner was anxious to play her in a tournament that was coming off in a few week's time, so, as I considered entire extirpation an impossibility, I left it alone, and told him I thought she would last over the tournament and very likely for some time after, but it was bound to be ultimately fatal.

I sent her out of hospital on 30th January with full directions for keeping the part clean. She played in the tournament at Umballa on the 25th February. The enlargement had by this time considerably increased, and the owner thought it scarcely worth while paying her railway fare back to Lahore, so he had her shot at Umballa. I was therefore unable to make a *post-mortem* examination.

The Professor of Pathology at the Lahore Medical College kindly undertook the examination of the growth when it was first excised, and he found it to be a true carcinoma.

MELANO-SARCOMA.

In February 1895 a gentleman brought a dark iron-grey country-bred pony, which he contemplated buying, to me for an opinion as to soundness. The animal in question was a five-year-old entire, and had on his right hind quarter a tumour about the size of a tangerine orange. This was of very firm consistence and quite painless. I thought it was a fibroma, and as the pony was in other respects

sound, and the intending purchaser liked his paces, I advised him to buy, which he did.

In January 1896, eleven months afterwards, he brought the pony to me again, saying that he did not want the pony for about six weeks, would I operate and remove the tumour. The latter at this time presented exactly a similar appearance to what it had before, and there was no appreciable difference in size or consistence. I admitted the pony to hospital, and a day or two afterwards operated on him. I found to my surprise on incising the skin that the tumour, which was intimately attached to the lower layer of the skin, was perfectly black, and the fluid that exuded from its cut surface stained the fingers. I dissected it from the under surface of the skin, as I (very foolishly as it turned out) wished to preserve the skin so as to leave as little scar as possible, and I could scarcely believe that the tumour I had looked upon for nearly a year as innocent could belong to one of the most malignant varieties. After incision the skin was brought together with silk sutures.

I sent the tumour to the Professor of Pathology at the Medical College, and shortly afterwards received a note to say that it was a melano-sarcoma of the large round-celled variety. He said that it was the most unusually pigmented tumour he had ever examined.

A week after operation, feeling rather anxious about the case, I examined it carefully, and found a considerable ring of black tissue growing at the periphery, so I had the patient again thrown, and excised the whole of the skin and subcutaneous tissue and a ring of healthy tissue around the part, leaving after the operation a wound in which half a cricket ball might have been placed. The wound did well, and the pony made an excellent recovery. No thickening remained, nor could I find any trace of recurrence or secondary growths when I examined him three months later.

The owner shortly after this time sold him, and I lost sight of the case.

Melanotic-sarcomata are some of the most malignant tumours that we have to deal with. I think this case has two or three interesting points.

First.—The long period, eleven months, during which the growth remained absolutely stationary.

Second.—How quickly local recurrence took place after imperfect removal.

Third.—The good results following radical removal. Unfortunately there was only three months after history, but I think if local recurrence had been going to take place, it would have shown itself in that time. It is quite possible, however, that secondary tumours were forming in the internal organs.

LYMPHO-SARCOMA.

Patient, bull-terrier, about three years old, the property of a native.

Brought to hospital 18th December 1895, suffering from a large tumour in the left groin. The owner was informed that excision was the only remedy, and he consented to the operation being performed. The growth was incised under chloroform, and I append the report of the Professor of Pathology at the Medical College.

"Tumour is irregularly elliptical in outline, measuring 10 by 6 by 5 cm. in its greatest diameter. The periphery is well defined and capsuled, colour on section pinkish red, consistence soft but fairly firm. On microscopic examination it proved to be a lymphosarcoma."

After the operation the wound did very well for nearly a month, but then several small nodular growths were seen near the edge of the almost healed wound, and one larger one very deep in the right groin. From their position and surroundings I concluded I was scarcely justified in operating again, so told the owner that the dog would ultimately have to be destroyed. The owner was much attached to the dog and wished to keep him as long as possible.

I asked him to let me have the body when the dog died, and he promised to do so. About the end of March the dog died and the owner had him buried at once, as owing to the usual native prejudice he did not want a *post-mortem* examination to be held.

THE USE OF ETHYL CHLORIDE AS A LOCAL ANÆSTHETIC.

By F. HOBDAY, Professor of Therapeutics, Royal Veterinary College, London.

AS I am unable to find any allusion to the use of this substance as a local anæsthetic in our text-books, I thought that perhaps a few notes on its application might prove of value.

Ethyl chloride is a clear fluid with an ethereal odour, and said to be absolutely non-poisonous; it is highly inflammable, and care must be taken not to work with it near a naked light. It is recommended in human practice for dental and minor surgical operations, and also for cases in which the application of intense cold is likely to afford relief. It is conveniently supplied in glass tubes specially designed to concentrate the stream on any particular area and to prevent waste.

In veterinary practice its action as a local anæsthetic is especially valuable for such cases as the removal of small tumours, sitfasts, etc., the painless lancing of abscesses, and various minor operations. The method of application is to clip the hair as closely as possible off the part to be operated upon, cleanse and dry the skin thoroughly, and then allow the stream of ethyl chloride to play upon it (holding the tube a short distance away) until the skin turns white; this takes place in from half a minute to a minute and half or two minutes. If sensation returns before the operation is finished the spray can be reapplied. The process of healing is not in any way retarded by the use of the anæsthetic.

The following cases will illustrate its action:—

CASE I.—27th May. St. Bernard dog, suffering from a large abscess under the throat. The hair was clipped off as closely as possible and the spray applied for one and a quarter minutes, when the skin was quite white; the animal was not secured in any way and

did not evince the slightest consciousness of pain; one and a half minutes later the wound was made larger by continuing the incision, but there was still no sign of pain.

CASE II.—28th May. Manchester terrier, operated upon for the removal of a sebaceous cyst. The spray was applied for one and a half minutes, when the cyst was painlessly excised. Sensation commenced to return one and a half minutes after the spray had been discontinued.

CASE III.—29th May. Fowl, for amputation of a digit. The spray was applied for three-quarters of a minute, and the bird evinced no consciousness of pain whilst the operation was being performed.

CASE IV.—3rd June. Fox terrier, to lance an intensely painful abscess in the right supra-orbital region. The spray was applied for one minute, the abscess being lanced and its contents squeezed out without any pain being evinced. Before the spray was applied it was only with the greatest difficulty that the abscess could be examined on account of the pain exhibited.

CASE V.—9th June. A very nervous, fat, pug dog with a large and painful abscess on the quarter. The spray was applied on the spot to be lanced for one minute, and the abscess lanced quite painlessly.

CASE VI.—Fox terrier, very vicious, suffering from a lipoma between the claws of the right hind foot. The spray was applied for three-quarters of a minute, and the tumour dissected out within the next two minutes without the animal evincing the slightest sign of pain.

A CASE OF EQUINE TUBERCULOSIS.

By G. C. HILL, M.R.C.V.S., Glasgow.

SUBJECT.—A valuable four-year-old colt, bred by the owner, first seen by us on the 28th day of November 1895. He had a companion, a half brother. During summer he went at grass, and was wintered in a box. His half brother under such treatment was in the pink of condition, but our subject was as described below. His appetite was fairly good, and he took a good deal of hay.

Condition.—Very thin, eczematous, dull and listless.

Head carried so that poll is in a horizontal line with withers; he is seen to lower head but not to raise it; stands in a corner of the box and is disinclined to move. When pulled out he does not brace up and draw himself together, but goes on in a spread-out style. He walks, trots, and backs sound, but sluggishly; turns very wide, more so to the near side. One can freely raise and lower his head, but he resents the turning it on to his shoulders, more especially to the near one. On this side, over the lower cervical vertebræ, there is a small painful swelling—hard, apparently bone. Nothing else can be seen amiss.

History.—This is meagre; the stud manager says that the colt did well until the end of season 1894, from which time he has got gradually to his present condition of a living skeleton, and that without any reason forthcoming, or cause apparent.

Prognosis.—Very unfavourable. Our advice was to apply the pole-axe, but the owner thought different.

Treatment.—Situation was a well lit, well ventilated, roomy loose-box in a quite but cheerful spot, with his companion visible next door; carefully and regularly groomed, diet very nutritious, exercised regularly, tonic and nutritive medicine given without success, the animal gradually becoming emaciated, did not lie regularly, and had to be assisted to his feet. About the 20th January 1896, he had to be placed in slings, and his legs were filling, so also the sheath; unable to stand, knuckling over at the hind fetlocks.

At last the owner decided to have the poor brute despatched on the 13th February 1896.

Post-mortem.—Lungs, liver, kidneys, stomach, bowels, and muscles all healthy. The spleen was enlarged, and contained about twenty tumour-like growths, in which Professor M'Fadyean subsequently found tubercle bacilli. When cleaned by boiling the lower cervical vertebræ were found to be much diseased. The bone had at some places been destroyed by some soft texture which was removed in the boiling, and at other places the outer surface of the bones was studded with small spiny projections of new bone (*see* Fig 3, Plate III.). Inquiry made after the colt's death elicited the fact that it had been very weakly as a foal, and that it had at times been fed with gruel and cow's milk.

SEVERE CASE OF PERICARDITIS IN A COW.

By R. S. SAUNDERS, M.R.C.V.S., Penzance.

THE subject was a seven-year-old milch cow in fair condition. The present owner had bought her, with a three-weeks-old calf by her side, at Easter. From then until now she had been, according to him, enjoying good health, excepting that she had been a little loose in her bowels, had not had a very good appetite, and usually breathed a trifle faster than his other cows. She had been giving three gallons of milk a day.

Since mid-day yesterday she has completely lost her appetite, has ceased to chew her cud, has had no passage of fæces, and has been lying on her sternum most of the time.

To-day (6th June) I find her in a very dull and weak state. Pulse 96, very feeble and small, in fact almost imperceptible. Temperature 93°; this being so abnormally low I doubted the exactness of my thermometer, but I had another cow brought in from the field, and found that it registered her temperature as normal; half-an-hour afterwards I obtained the same reading with another thermometer. Respirations quiet, fourteen per minute. The surface of her body was very cold, as were also her limbs, horns, and ears. On introducing my hand into her mouth, anus, and vagina, these passages felt as cold as those of a dead subject. I noticed a slight "twitching" of the muscles of the fore and hind limbs at times. The visible mucous membranes were pale, almost colourless. Her milk secretion was stopped. With a little persuasion we got her on her feet; she was

very disinclined to move, and when made to do so she walked in a very weak manner. On auscultation I found the heart to be beating tumultuously; the two sounds could not be distinguished, but each beat gave rise to a characteristic "gurgling" sound.

7th June. She was down, and we could not get her up. She has eaten nothing. Has had no passage of fæces. Surface temperature a little better, and rectal temperature 98·6° (this was probably due to a pint of rum administered last night). Pulse 100 and a trifle fuller. Breathing more frequent, laboured and abdominal, each respiration shaking the whole body. She died about half-an-hour afterwards.

Post-mortem examination revealed very extensive pericarditis. The pericardial sac contained about two gallons of very putrid pus. The parietal layer of the pericardium was much thickened through the deposition of layers of granulation tissue and coagulated lymph. The surface of the heart was covered with large vegetations (cor villosum), otherwise presenting the same surface appearance as the parietal layer. The heart muscle was pale and flabby. I could find no trace of any foreign body in the pericardium, but possibly there might have been some small object which started the process, but had now become disintegrated.

Remarks.—Considering the time the inflammatory processes must have been in progress, it is rather peculiar that the animal gave no previous signs of indigestion or heart failure. Another peculiarity was the suddenness of the attack and the rapid death, in view of the considerable time that the animal must have had the disease without showing any observable symptoms. I was unable to detect any intermittency of the heart-beats or any inequality of the pulsations.

A CASE OF VOMITION IN THE HORSE.

By HARRY GOODWIN, F.R.C.V.S., Antigua.

THE following is the report of a case of vomition in the horse which I lately had under treatment, and which I consider uncommon from its apparent simplicity.

The literature on the subject though extensive still commands attention and is of interest, grave doubts existing in the minds of veterinary surgeons with regard to its value as a diagnostic aid.

On the 19th June I was asked to attend a sick horse which was vomiting its food. Appreciating the gravity of the report and the danger of delay, I paid a visit immediately.

The animal was a very aged one, standing 17 hands high, and had at one time possessed an exceptionally good constitution. I found it standing, the head held well up, feet firmly planted on the ground, the fore rather wide apart from the hind, as if on show, and decidedly disinclined to move, eat or drink.

The manger and what little was left of the supper was pretty freely besmeared with ingesta rather fluid in character. The temperature was 101° F., pulse full and frequent, respirations accelerated, mucous membranes reddish-yellow, defecated and urinated freely up to the time I saw it.

The information given was, that it appeared dull whilst working the day before, but ate and drank freely, and when suppered up at night showed no signs of approaching illness.

I had it moved a few yards, and minutely examined its throat, neck, chest, and rectum, but that the teeth were very bad was all I found.

Whilst making the examination it lowered its head and neck, drew in its flanks, and emitted through its nostrils from 4 to 6 ounces of a greenish, frothy fluid, immediately after which it gave a single cough, rather full and moist in character.

I had all but the greenest and softest food removed, and ordered a drink to be given, containing bicarbonate of soda and nux vomica. Almost the whole of the drink was returned in a short while, and I ordered a second dose to be given in an hour or two. This latter was kept down for a longer period. I then ordered hot linseed meal poultices to be applied every two hours to the abdomen, and every fourth hour a drench containing tincture of nux vomica and compound tincture of gentian was given. From the beginning of this treatment a change for the better took place.

On the 20th the temperature had gone up to 103° F. The mucous membranes were injected, and passing with the fæces was a quantity of stringy mucus. The animal had scarcely moved and had eaten nothing. It passed urine freely. I allowed linseed meal gruel *ad lib.* This treatment I continued for a few days with very satisfactory results.

It is generally advocated that in cases where there are no appreciable symptoms of structural changes having taken place, and it is simply a case of distension, a purgative should be given. Vomition will occur not only where there is no apparent distension, to judge from the quantity and quality of the ingesta ejected, but also where there is no closure of the pyloric opening, to which some attribute the occurrence of this act.

That the horse suffers from nausea, whether from a sea voyage, indigestion, the effects of medicinal agents, etc., and that nausea will produce vomition, is acknowledged; but who is able, and by what means is it possible for one, to come to the conclusion that anyone of the above, unassociated with such grave complications as engorgement, impaction with fermentation paralysis, is present? Not from the symptoms manifested, as one will get sweats, partial or otherwise, frequent respirations, increased frequency and weakness of the heart's action, with tremors of the muscles, in simple cases of colic, according to the strength and capabilities of the animal for bearing pain. Nor will one be other than disappointed if one expects to find indications of cerebral complications to depend upon, or signs of blood with the excrement to assist one.

There is proof of one thing only, and that is relaxation of the muscular loops of the cardiac end. To give a purgative under such circumstances I consider dangerous. Matters are made worse by increasing the nausea, rendering more acute the symptoms, and weakening the organ and patient.

It has not been shown, nor is there any indication, that at all times an opposite condition of things is in existence with regard to both ends of the stomach, or that another centre is in existence in the

medulla, or anywhere else, acting antagonistically. Rather the reverse.

In cases of impaction the least harmful thing a purgative appears to me to do is to swell the contents of the already overloaded stomach, and in cases of nausea to further excite an organ already made irritable. It will not cause the cardiac end to close, nor does it tend, in any way, when there is opening of the other end, to assist in putting the food into the small intestines.

How much worse must it be then, when we have engorgement with fermentation and relaxation on paralysis. The already weakened organ must be brought dangerously near rupturing itself.

Some months ago I attended a case manifesting all the symptoms of colic. It was exceedingly restless. On one occasion, as it lay or rather dropped on the ground, it emitted, principally through its nostrils, about half a pint of very soft ingesta. I had administered an alœs purge of fomentations continuously applied, and relieved the pain by hypodermic injections of morphia and atropine. It died the next day. I made a *post-mortem* examination, and found the stomach impacted with dryish ingesta. Very little food in the small intestines, which were inflamed.

Another case to which I was called showed signs of very acute colic with slight flatulency. An alœs purge was first given, and about two hours afterwards 8 ounces of linseed oil. Sedatives and anodynes frequently ; hot fomentations continuously. Little or no relief did the poor brute obtain. It died the next morning. It had commenced to vomit about half an hour before death, the acts being nothing more than attempts, and following each other frequently. The *post-mortem* examination revealed the stomach thoroughly impacted and distended with ingesta, and ruptured, the rent being fully 8 inches in length. If relaxation from the cardia to the pylorus facilitates the passage of the contents, there was nothing to prevent it here. I am of opinion, from the symptoms at the last, that this was a case of vomition immediately following rupture.

I have seen cases of vomition with rupture of stomach and twist of the small intestines, death occurring from twelve to fourteen hours after the animal first manifested signs of illness, and the *post-mortem* has revealed the stomach distended with the food partaken of prior to, and that which it was eating at, the time of first attack. The medicine soaked into the ingesta, and some of it had passed through with a small quantity of that into the intestines.

The symptoms in these cases at the last are exceedingly distressing and painful to witness.

Abstracts and Reports.

TUBERCULOSIS IN SAXONY IN THE YEAR 1895.[1]

In the twenty-nine towns in Saxony in which a regular meat inspection is carried out, the number of cattle slaughtered during the year 1895 was 82,787, and the number of these in which tuberculous lesions were found was 22,758, or a proportion of 27·48 per cent., as against 21·5 per cent. in the previous year. The proportion varied in different districts, from Meissen with 49·7 per cent. to Werdau with 7·34 per cent. Of these tuberculous animals 21,062 were passed as fit for food, which is equivalent to 92·54 per cent., as compared with 91·40 per cent. in 1894; 1256 of the tuberculous carcases, or 5·51 per cent., were sold in the Freibank; and 440, or 1·93 per cent., were condemned as totally unfit for food and destroyed.

With regard to the distribution of the cases according to sex, the following figures are given. Out of 25,145 oxen, 6116, or 24·31 per cent., were tuberculous. The highest proportion of tuberculous oxen was furnished by Meissen, namely, 38·9 per cent. Out of 39,493 cows slaughtered during the year, 12,832, or 32·49 per cent., were tuberculous. Meissen again furnished the highest percentage, namely, 52·9 per cent. The number of bulls slaughtered during the year was 18,149, and of these 3811, or 20·99 per cent., were tuberculous. In this case also Meissen furnished the largest proportion of tuberculous animals, namely, 51·1 per cent. The number of calves slaughtered during the year was 201,643, of which number, 503, or ·24 per cent., were found to be tuberculous. Of these tuberculous calves 129 were destroyed, while 148 were sent to the Freibank, and 226 were passed for unrestricted sale.

The number of sheep slaughtered during the year, was 132,578, and among these there were detected 179 cases of tuberculosis, or ·13 per cent. Sixteen of the tuberculous carcases were destroyed, fifteen were sent to the Freibank, and 148 were passed for unrestricted sale. In one district the proportion of tuberculosis among the sheep slaughtered was as high as 3 per cent.

The number of goats slaughtered during the year, was 3007, and thirteen of these were found to be tuberculous. Three of the thirteen carcases were destroyed, two were sent to the Freibank, and eight were passed for unrestricted sale.

The number of pigs slaughtered during the year, was 384,473, and among these tuberculosis was detected 10,450 times, giving a proportion of 2·71 per cent. Of the tuberculous carcases, 149, or 1·42 per cent, were destroyed; 1962, or 18·77 per cent., were sent to the Freibank; the fat of 573 tuberculous pigs was also sent to the Freibank; and 7766, or 74·31 per cent. were passed for unrestricted sale.

EPIZOOTIC CEREBRO-SPINAL MENINGITIS IN THE HORSE.

In a recent number of the *Archiv für wissensch. u. prakt. Thierheilk.* (Bd. 22, H. 4 u. 5, 1896) Siedamgrotzky and Schlegel describe their observations regarding a peculiar form of disease which is at the present time prevalent among horses in some parts of Saxony. The disease in question made its first appearance in 1878, in April of that year four horses in Zwickau being

[1] **Bericht über das Veterinärwesen im Königreich Sachsen für das Jahr 1895.**

attacked with peculiar symptoms indicating subacute meningitis. In 1879 a number of outbreaks occurred at different places, and the affection was known as the "new disease" by laymen in these districts, but by veterinary surgeons it was generally recognised as cerebro-spinal meningitis.

For some years after 1879 only occasional cases were reported, but between 1883 and 1886 the disease again became widely prevalent. No cases were reported in 1887 or 1889, but in 1890 another recrudesence of the disease set in, and since that time it appears to have been steadily on the increase. The worst year of all has been the present one, no fewer than 457 cases having been reported between January and May.

Symptoms and Course.—The disease either sets in suddenly with rigors, or premonitory symptoms are observable for some days. These consist for the most part of signs of moderate gastric catarrh with some degree of dulness; the pulse and respiration are at first normal; in some cases polyuria is a premonitory symptom.

The peculiar disease begins either with mental disturbances such as are seen in subacute meningitis of the horse, or these may be added at a later stage to the peculiar symptoms of cerebro-spinal meningitis.

The sensibility of the skin is diminished, and consciousness is dulled or completely lost. The animals stand in a sleepy position with the head hanging or supported on the manger; there is frequent and repeated yawning; the animals are with difficulty made to move, sometimes stumble and even fall down. Delirious attacks are rare, but occasionally set in at a later stage in such a degree as to make it scarcely possible to approach the patient. A peculiar feature of the disease is the appearance of symptoms of irritation or paralysis in various groups of nerves. At the outset the pupil is contracted, but sometimes that is replaced by marked dilatation. Sometimes the direction of the eye is changed, a downward squint being especially frequent. The power of vision is not distürbed.

In the group of head muscles irregular vibrations of the lips, twitching of the face, eyelids, and ears, are observable; this may be followed by paralysis with hanging of the lips, drooping of the ears, etc. These symptoms, however, are not always present. More constant are disturbances in connection with the muscles of mastication, prehension, and deglutition. At first firm closure of the mouth and movements of mastication are observed although no food is present in the mouth; later there is frequent and persistent grinding of the teeth. In consequence of the partial loss of consciousness the patients ordinarily cease to take food or drink. When food is held before them or the head is pushed into it they seize some of it, chew it slowly with extensive movements of the jaws, and swallow it; at a later stage the animal loses the power of seizing the food, especially grains. Eventually the power to carry any sort of food into the mouth is entirely lost, although there does not appear to be any paralysis of the muscles of the cheek or of the tongue. When food is pushed into the mouth it collects there between the cheeks and the teeth. These symptoms appear to be due not to a complete paralysis, but to an inability to execute in a co-ordinate manner the movements of mastication. Notwithstanding this, the power of deglutition is often retained for a long time; eventually, however, that also may be lost, and then the saliva flows from the mouth, and when an attempt is made to swallow the liquid returns through the nose or may be aspirated into the trachea, and in that way pneumonia may be set up.

Disturbances in connection with the muscles of the neck are very frequently observed, although not constantly present. The most common amongst these disturbances is a cramp-like contraction of the extensor muscles of the neck; in consequence of this the head is stretched out, or permanently curved in the upward direction, the extensors of the neck

feeling as firm as in a case of tetanus. When in such a case an attempt is made to bend the neck this is found to be impossible, the patients either falling backwards or to the side. Not infrequently the contraction of the muscles of the neck is unequal on the two sides, so that the neck is permanently bent towards one side. Under the action of a stimulus, as, for example, when food is held in front of the animal, this unilateral contraction becomes increased, and the neck is then so strongly curved that the lips may be brought into contact with the body behind the shoulder, and even in this position the animal attempts to take food or drink. In some cases the neck is bent so as to carry the head low down, this being especially observed when there are sensorial disturbances. The head then frequently becomes œdematous, as in a case of purpura. In addition to these symptoms, fibrillary trembling of the muscles of the neck occurs, and at a later stage the chronic cramp-like contraction may be accompanied by extensive twitching of some of the neck muscles.

As a rule similar symptoms are not present in connection with the muscles of the body or limbs, but sometimes there is stiffness of the back, and at others peculiar cramp-like movements of one leg, the affected limb being carried far upwards and forwards.

As a rule the animals perform peculiar circus movements in progressively diminishing circles. Loss of the power of equilibrium is also frequent; the animals then stand with the feet wide apart, and sway on the hind limbs. When made to move the patient has a tendency to stumble, and not infrequently falls down altogether. Very frequently when this has happened it is found to be impossible to keep the patients on their legs by artificial aid; they then lie, completely unconscious, on the ground, and periodically make violent swimming movements with their legs. When in such a case the animal does succeed in getting on its legs again it rushes blindly forwards, until stopped by walls or manger, or until it falls down. In occasional cases the animals without any apparent motive repeatedly bite at the muscles of the hind leg.

As regards general symptoms, it was observed that the body temperature varied between 37·5° and 41° C. Most frequently the temperature was about 39°, and the course of the temperature curve was irregular. The pulse was sometimes normal, and sometimes moderately increased (about 50 as a rule); it is not full, but rather empty and soft. Except during excitement, or during an attack of intercurrent pneumonia from the entrance of foreign materials into the trachea, the respiration is tranquil. The temperature of the surface of the body is unequal, the legs mostly being cold, whereas the skull and the neck commonly feel hot. Very frequently the visible mucous membranes show nothing abnormal; at other times they show a slight yellow tinge, and in still other cases a bright red colour. In very severe cases the conjunctiva becomes livid.

As a rule the appetite is retained, but, as already mentioned, the horses are unable to lay hold of food, or to masticate it. As a rule, there is slight constipation. In general the urine appears to be unchanged, but some observers have reported the presence of albumen, red corpuscles, and cylinders in it.

The course of the disease is generally somewhat slow. All the symptoms increase in intensity in the first four to eight days. The disease then remains at its height, with moderate remissions or exacerbations, until, owing to increasing paralysis, death takes place from the tenth to the eighteenth day. Death may be hastened by inability to take nourishment, by fracture of the skull in consequence of the violence of the animal's movements, by pneumonia in consequence of the penetration of food materials into the air passages, or lastly, by septicæmia following on extensive necrosis of skin of the various parts of the body pressed upon when the animal lies persistently.

When the disease ends in recovery that proceeds slowly, and requires several weeks. As a rule the cramp of the muscles and the partial paralysis disappear first, while the general mental disturbance remains for some time longer. Very frequently the recovery is incomplete, some degree of mental depression remaining permanently. Sometimes also the power of equilibrium is not completely recovered, so that the animals display a want of power of co-ordination. Loss of sight in one or both eyes is somewhat frequently observed as a result of inflammatory changes in the optic disc.

According to reports collected from veterinary surgeons, out of 780 cases 595 died, or had to be slaughtered as useless.

The *post-mortem* examination showed the lesions of a serous leptomeningitis affecting the brain, medulla oblongata, and adjoining parts of the spinal cord. In the subdural space, between the meshes of the arachnoid, there was found a large quantity of almost clear fluid, and a similar fluid was present in greater or smaller amount in all the ventricles of the brain. The vessels of the pia mater were markedly injected, especially at the basal part of the brain and the medulla oblongata, from which point it gradually diminished in intensity, until it disappeared about the second or third cervical vertebra. The choroid plexus was also injected, and at some places showed gelatinous swelling. The furrows between the cerebral convolutions, especially on the basal aspect of the brain, appeared flat and more or less filled with serous lymph. In the white substance of the brain the vessels were more or less full of blood, but with scarcely any capillary hæmorrhages and slight œdema. The grey substance of the brain had a tinge of violet, and was somewhat softer than normal, especially at the base of the brain. These changes were most marked in the pons and the medulla, but were present as far as the second or third cervical vertebra. Some observers had noted similar alterations in the lumbar part of the spinal cord. The crainal nerves, especially the fifth, appeared softer than normal and somewhat yellowish in colour. The hypophysis cerebri was swollen and softened.

No lesions except such as appeared to be of an accidental character were present in any of the other organs.

Etiology.—At first various influences were accused of being responsible for the production of the disease, but gradually the opinion has come to prevail that the disease is of a specific infectious nature. With respect to this question, it was to be observed that the disease was mainly confined to farm horses; horses in towns and those which were regularly worked every day were seldom attacked, and only a few cases occurred in two cavalry regiments stationed in the district. Both coarse and well-bred horses were attacked, and while most of the animals affected were of middle age, the disease was seen even in old animals. Out of 751 cases six animals were under one year, 149 between one and five years, 332 between five and ten years, 170 between ten and fifteen years, and 94 fifteen years and over.

The distribution of the cases with regard to the time of the year is shown in the subjoined table:—

1895		1895		1896	
January	4	July	19	January	51
February	13	August	32	February	75
March	27	September	18	March	167
April	34	October	10	April	141
May	52	November	11		
June	33	December	18		

Opinion with regard to the operation of contagion in the spread of the disease was much divided. Twenty-four veterinary surgeons who had had a large experience with the disease believed that it was not contagious; four believed that they had observed instances of contagion, and seven left the question undecided. The proportion of cases in which there was any history of contagion was very small, and in some instances it was observed that where several cases occurred in one stable the new cases occurred in horses remote from those first attacked. Lastly, it was declared that in some instances the disease broke out among horses that for half a year had been placed in circumstances that seemed to preclude contagion. From all the evidence it appeared that the disease was only exceptionally transmitted from one horse to another.

Culture experiments were made in nine different cases, and in 80 per cent. of these pure cultures of a particular micrococcus were obtained from the cerebro-spinal fluid or the brain substance. Cultures of this micrococcus were found to be non-pathogenic for mice and rabbits. Intravenous injection of cultures in three horses did not induce the specific disease, but in one horse which received an intravenous injection brain symptoms somewhat similar to those seen in the disease afterwards set in. In another case similarly infected symptoms of slight brain affection developed, and at the *post-mortem* examination the same micrococci could be recognised in the cerebro-spinal fluid as well as in the substance of the brain and spinal cord. In still another case subdural inoculation of a horse with a culture of the micrococcus was followed by severe meningitis and encephalitis, and here again the micrococci were present in almost pure culture. On the ground of these observations and experiments it is held to be probable that the before-mentioned micrococci, under favourable circumstances, can produce the disease.

SIXTH INTERNATIONAL VETERINARY CONGRESS.

DISCUSSION ON THE USE OF THE FLESH OF TUBERCULOUS ANIMALS.

The Sixth International Veterinary Congress, which met at Berne in September 1895, devoted part of two of its sittings to this subject. The following report of the discussion is translated from the recently issued official report of the Congress. The subject was introduced by papers contributed by Messrs Guillebeau, de Jong, and Butel, who were called upon to open the discussion.

HERR GUILLEBEAU —The standpoint from which I have proceeded is that tubercle bacilli, when they reach the intestine in a living condition, act injuriously on the animal which takes them in. I think that this point will not be disputed. The second point is that when parts which are the actual seat of tuberculous disease are eaten in the raw condition these are naturally also injurious. This point also is not disputed. A third point, which I also take to be undisputed, although, strange to say, in discussions such as this it has been left in the background, is the richness of the flesh in tubercle bacilli. The flesh contains them in the capillaries, into which they are carried by the blood stream. Bollinger has shown that this is a constant condition in advanced (*hochgradiger*) tuberculosis, but it also occurs sometimes in less advanced cases. Proof of this is furnished in the fact that in cases of quite moderate tuberculosis in cattle metastases in the mammary gland, brain, and other parts, are of frequent occurrence. We very frequently observe that inflammation of a joint is the primary disease, especially in commencing

tuberculosis. These metastases would be incomprehensible if we could not assume that from time to time tubercle bacilli are carried into the affected parts by means of the blood stream. But the bacilli have been directly observed in the blood of tuberculous animals and also in the flesh; the experimenters who have made these observations are known to you. All the experiments on this head may be divided into two groups, namely, the positive, which are unambiguous, and the negative, which I hold to be not so unambiguous as they have frequently been represented. In the latter cases it ought not to be forgotten that when the juice of the muscle is pressed out (for inoculation not so much as a couple of grammes of flesh are used), the filter action of the flesh does not easily allow the bacilli to pass through, and these may very well be retained, so that the juice may be free from bacilli while the flesh itself contains them. Moreover, I cannot regard as convincing those experiments in which the animals which one attempts to infect by feeding possess a normal physiological immunity against the disease. A number of animals which are susceptible to tuberculosis by inoculation are not susceptible by feeding; the best example of that is the goat. That this animal is very seldom the subject of spontaneous tuberculosis is well known, but the experiments of Bollinger have shown that it can very easily be infected. The fact that the goat does not become tuberculous, although tubercle bacilli are taken into its body, proves that some means of protection is present. What that is I do not know, but I think that it is the gastric juice and the very efficient digestive organs. However, I will not ask for any proselytes to this view. As has just been said, the goat, although kept in worse circumstances than the ox, very seldom becomes tuberculous, and the same is the case with the guinea-pig. This animal is extremely susceptible to inoculation, but it is comparatively well protected in respect of spontaneous infection. I say, therefore, there are two possibilities before us: either no bacilli are present, or if such are present, the natural protective means have sufficed for their destruction.

I thus maintain that in a tuberculous animal, even although the seat of disease is still small, tubercle bacilli at certain times are found in the blood, and I come to this opinion on the ground of numerous *post-mortem* examinations. It is absolutely erroneous to believe that tuberculosis is spread only by way of the lymphatic vessels; it spreads as frequently by means of the blood stream. You are all acquainted with the experiments on guinea-pigs. When we inoculate such subjects subcutaneously the nearest group of lymphatic glands become first attacked, but even in this animal the spread of the disease is certainly not by means of the lymph stream, but by the blood stream, which plays the chief *rôle* in the dissemination. I say all this in order to show that when one speaks of tuberculous animals one must conceive of bacilli in the muscular tissue as well as in the lymphatic system. Hitherto all attention has been paid to the condition of the lymphatic glands, and we know how very contradictory have been the opinions and decisions given by various authorities. Indeed a small volume might be written regarding the variability of opinions with respect to the generalisation of tuberculosis; you know that every two or three years opinions on that subject change, because they lack a scientific basis. In the dissemination of tuberculosis the blood is as important as the lymph stream.

While I cannot attach any great *rôle* to the condition of the lymphatic vessels, it is also difficult for me to judge of the richness of the blood in bacilli from the apparent condition of the lesions. What is to be inferred from the *post-mortem* examination? It gives us some information regarding the dissemination of bacilli in the blood during the previous three weeks, but not during the last few days. If I were from the result of the *post-mortem* examination to draw a conclusion as to whether the flesh is infectious or not,

that would be about the same as if I were to predict what the weather will be in three weeks from what it is to-day; in that way I could only come to a wrong conclusion.

Another point which has, I think, been too much discussed relates to the economic side of the question. It has been said "the flesh of tuberculous animals is, after all, seldom infectious, and inasmuch as the injury to agriculture would be very great, we must save a great deal of this flesh." I think that is not a scientific position to take up. One thus mixes up two things which ought to be kept separate. How great must the danger be before the hygienic organs will think it worth their while to be concerned about it? I would like someone to tell me how many bacilli are admissible, and how many not. According to a small calculation which I have made, every one of us eats yearly flesh from about 200 cattle, which makes in forty years 8000 animals. If the flesh of a single one of these 8000 animals is virulent, that is perhaps very little from the point of view of national economy; but when I come into the position of having to eat this eight-thousandth part, that is enough, indeed I think it a great deal too much. It is therefore dangerous to altogether overlook the risk because it is not great; smallness of risk of infection is not identical with absence of it. In Westphalia only one pig in 30,000 is trichinous, but, nevertheless, trichina inspection has been introduced there, because they have found out that it is worth their while to do so even with only one pig in 30,000 affected.

On all these grounds it has not been possible for me, much as I should have liked to do so, to classify flesh into noxious, semi-noxious, and innocuous; such a classification lacks every scientific basis.

I have given prominence to another point which many of those present will consider a great heresy, that is the disinfection of flesh by ordinary cooking. There are two things here that must be kept apart: we must ask ourselves how does the bacillus behave generally with regard to heat, and what is the conducting power of flesh for heat? That the bacillus is extremely sensitive to heat has been shown by the experiments of Yersin. A temperature of 55° centigrade is already very injurious to it; a temperature of 60° C. is still more so, and at 70° C. the bacillus is quickly destroyed. It may be said that in the interior of flesh things proceed otherwise; with regard to that point it may be remarked that naturally not only the height of the temperature has to be taken into consideration, but also the duration of it. Even a duration of ten minutes is very injurious; cooking lasts somewhat longer, and thus there arises a second factor which may contribute to the destruction of the bacilli. I have thus put forward the view that ordinary cooking will destroy the bacilli, and I rest this on the experiments with trichinæ; these are very injurious inhabitants of the flesh of the pig, and when anyone eats such flesh in the raw condition he is certain to become severely affected. But here we do not meet with trichinosis, not because our medical men would not be in a position to diagnose it, but because with us trichinæ give us no anxiety owing to their being killed by heat. I have thus come to the view that when the flesh is eaten well cooked, that is to say, when the red colour has been changed to a distinct grey, the bacilli are dead; and when this is done it is sufficient to remove all the actually diseased parts, since the bacilli which are found in the blood capillaries will be destroyed by heat. I am well aware that this plan is not sufficient in places where the flesh is eaten raw, and I here hold it to be scientifically impossible to draw a sufficiently distinct line between flesh which may be sold without any restrictions and flesh which may not be so sold. I incline rather to the view that the flesh of tuberculous animals, if it has to be eaten raw, ought to be excluded from the market, and it is here that the Freibank rightly comes in. Much may be said against this, and I am not

going to praise it too highly, but everyone has the duty of looking after his own health, and when anyone buys meat at the Freibank he knows that it ought not to be eaten uncooked.

Sterilisation is naturally the ideal way of dealing with such flesh, and I do not doubt that it has a great future before it. Up till now the reports from Germany are encouraging, and I believe that they will be still better with more convenient methods, and if the thing is taken commercially in hand.

To come back once more to the question of cooking, I shall be told that it is the custom in all parts of the world to eat flesh raw; that, however, is true, for only a small part of the upper ten thousand, who feel themselves constrained to imitate more or less a custom introduced among us from England. But with the great mass of the people, with whom we are in the first line concerned, this does not apply; here, and also in France and Germany, ninety per cent. of the people do not feel inclined to eat flesh raw, and as for those who wish to eat in the English fashion, and their number is small. care for them might be taken by the introduction of special regulations. Indeed, I find this question of eating raw flesh not interesting, for I have always thought that the fire was a great step towards civilisation, and when we cook meat we kill many other bacilli, the destruction of which is as important as that of tubercle bacilli. The cases of extensive poisoning in the Canton of Zurich are not ascribable to tubercle bacilli, and they would not have occurred if the flesh had been thoroughly cooked. We need not therefore pay much attention to this Anglomania.

The resolutions which I move are briefly as follows:—

First.—The introduction of the bacillus tuberculosis into the digestive organs of the human subject is capable of setting up tuberculosis.

Second.—The apparently normal flesh of tuberculous animals sometimes, though perhaps seldom, contains tubercle bacilli.

Third.—This follows from the fact that tuberculosis is mainly spread by way of the blood stream.

Fourth.—Post-mortem examination gives no information regarding the richness of the blood and the flesh in bacilli.

Fifth.—The now customary tuberculin injections tend to bring about a generalisation of the tuberculosis.

Sixth.—The relative rarity of the bacilli in the blood and flesh is not, from a public health point of view, equivalent to the absence of these.

Seventh.—Tubercle bacilli are quickly destroyed at a temperature between 70° C and 80° C.

From the foregoing conclusions it follows:—

First.—That in countries in which it is the custom to eat flesh only in the cooked condition, the sale of the flesh from tuberculous animals may be permitted, provided the condition of the flesh is good and the visibly diseased parts have been removed.

Second.—That in countries in which the flesh is consumed in the raw state, the flesh of tuberculous animals, no matter in what stage the disease is, ought not to be sold except in the Freibank, or, which is greatly to be preferred, in the sterilised condition.

Appendix.—The most efficient means of combating tuberculosis of cattle consists in the careful collection and destruction of the sputa of tuberculous human beings.

In moving these resolutions I may say that their adoption would give me particular pleasure, inasmuch as that would do away with a very unfortunate state of affairs, viz., the divergence which everywhere prevails between theory and practice. It is easy to legislate on paper regarding tuberculosis, but in practice the regulations are not paid attention to. In order to remove this unfortunate state of things, which is not to the credit of our calling, I hold

that we ought to come to a unanimous decision on the subject. In conclusion, I may add that some of my colleagues, who have also written on this subject, have considered not only the use of tuberculous flesh, but also meat inspection in general; all resolutions of that sort I, of course, support. I also am in favour of obligatory meat inspection, but I did not think that I ought to contribute to a consideration of that subject, as former congresses have authoritatively dealt with it. At the same time, if it is thought necessary to break a lance for obligatory meat inspection, they will find me on their side.

M. DE JONG.—I should like to add a few words to the small paper which I have prepared on this subject.

Notwithstanding the various experiments made to demonstrate the danger presented by tuberculous flesh, in spite of the numerous manuals for inspectors of meat, and in spite of the conclusions of various congresses, a unanimous decision regarding the consumption of the flesh of tuberculous animals has not yet been arrived at; that still remains a burning question.

Some declare the flesh of every tuberculous animal dangerous, others think it so only in certain cases, and, finally, a small minority affirm that the danger does not exist at all.

As for me, I belong to the second category. I have founded my opinion on the interpretations of the various experiments and observations which I have been able to make.

It is the different interpretations of the same facts which has given rise to the diversity of opinion.

Let us hope that we shall soon arrive at unanimity and see things in the same light. That is far from being the case at the present day.

Even for a partisan of total seizure the flesh seized on account of tuberculosis, that is to say, that which being susceptible of infecting the human subject cannot be passed for human consumption, forms a quantity which cannot be neglected, and which represents a pretty considerable value.

In case of the destruction of this flesh it is the proprietors who bear the loss, or when they are compensated the national capital is to that extent diminished.

The question arises, Are there any means by which the dangerous properties of this flesh may be removed? The reply, fortunately, is in the affirmative.

The healthy flesh may be passed when we are sure that the virulent material, the bacilli of Koch, have been killed.

Thus, experiments have shown that the bacilli are killed in a short time under the action of a temperature of 70° C. (in half-an-hour); at 100° C. the bacilli lose their vitality in a few minutes, and in a still shorter time at a more elevated temperature.

Hence, it might be said that nothing could be easier than to render tuberculous flesh wholesome. Our kitchen ranges will expose the flesh to a temperature of about 100° C. or more, and will thus sterilise it.

Unfortunately such is not the case. The flesh absorbs the heat too slowly to permit of a sterilisation sufficient to preserve human beings from all danger. In the majority of cases, in fact, the temperature does not attain 60° C. in the interior of the flesh, as has been proved by various experiments. Quite recently the researches made by the Royal Commission for the study of tuberculosis in England have proved that tuberculous flesh, even after cooking, may still be capable of infecting pigs by *inoculation*.

It is on that account that I am not in favour of sterilising recognisably dangerous tuberculous flesh by cooking.

There are other means of completely sterilising the flesh without causing it to lose all its nutritive value, and these means we possess. They consist of the apparatus of which I have spoken in my paper. Anyone who has partaken

of the tuberculous flesh sterilised by this apparatus will comprehend the decided advantage which it offers.

That is what has led me to the conclusion which is formulated in the following resolution :—

In disinfection or sterilisation we now possess a means by which the use of tuberculous flesh is deprived of danger for human beings. The employment of this method appears to be indicated as soon as the value of the flesh after sterilisation exceeds the cost of the proceeding. With this object in view the erection of sterilising apparatus ought to be strongly encouraged.

I have to add some propositions which I shall place in the hands of the General Secretary.

1. *The total seizure of the flesh of tuberculous animals, although it may be desirable, is not practicable, owing to the considerable amount of capital which would be destroyed under such a system.*
2. *When the flesh of tuberculous animals is passed for food it ought to be sold with a declaration of its nature.*
3. *It is not necessary to destroy the healthy flesh on account of tuberculosis; such flesh may be passed after sterilisation.*
4. *Sterilisation ought to be practised in a special apparatus.*
5. *The installation of apparatus for sterilisation ought to be undertaken wherever it is possible.*

M. BUTEL.—With your consent I will give a *resumé* of the paper which has been placed in your hands either in French or in German.

You are acquainted with all the scientific points on which practical deductions and hygienic applications have been founded. Consequently, I think that I should be making a bad use of the time of the Congress if I were to repeat what is already well known to you at this moment. I shall therefore pass at once to the practical deductions.

The conclusions that terminate the paper which has been distributed to you are radical conclusions. Since I have been here I have had occasion to converse with eminent scientific men from the various European countries, and after a prolonged discussion with them I have been led to modify the resolutions, so as to present them to you at this moment under a more acceptable form, I believe, than they had in the first place, in which they reflected my own personal view of the question. These new conclusions are supported by MM. Arloing, Chauveau, Degive, Furtuna, Hendricks, Hutyra, Imlin, Kaiser, Laho, Leistikow, Locusteanu, Lothes, Lydtin, Mosselmann, Müller, Nocard, Perroncito, Pütz, Schmaltz, Trasbot, and Wirtz. These conclusions are the result of an understanding which has been arrived at in order to permit the Congress to pronounce an opinion without hesitation. I shall ask the President to be good enough to put them for discussion one by one. MM. Guillebeau and de Jong, who have also contributed papers on this subject, are in accord with us with regard to a large number of points, if not the whole.

Our propositions are as follows :—

1. *The flesh of tuberculous animals ought to be submitted to special regulations.*
2. *When these regulations entail seizure the proprietor ought to be equitably compensated.*
3. *Seizure is to be practised when, owing to their extent or their character, the tuberculous lesions appear to render the flesh dangerous.*
4. *The flesh seized shall be absolutely condemned*:—
   (a) *If it comes from an emaciated animal.*
   (b) *If it presents an unhealthy appearance.*
   (c) *If lesions are present in the muscular system.*
   (d) *If lesions are present in several viscera.*

5. *It is desirable that when the flesh of tuberculous animals is thought fit for consumption it should be sold in special places, with a declaration indicating its source, and after it has been subjected to efficient sterilisation.*
6. *The Sixth International Congress of Veterinary Medicine emits the view that the various Governments should give every possible eucouragement to the erection of apparatus for the sterilisation of flesh.*
7. *It calls the attention of the different States which are specially represented at it to the necessity of introducing a general system of meat inspection.*

I ought to say that these resolutions have not been drawn up by me alone; they are the result of a deliberation between a certain number of colleagues, to whom the honour belongs.

The PRESIDENT.—I have taken note of M. Butel's wish in the matter, but I cannot give effect to it immediately, as several intending speakers have sent in their names, and the discussion has now to proceed.

M. BUTEL.—I quite agree with that.

PROFESSOR M'FADYEAN.—In Great Britain, as elsewhere, the subject of tuberculosis in the lower animals, and its possible relationship to the prevalence of the same disease in the human subject, has recently been much discussed by those who take a special interest in public health. With us, as in France, opinion regarding this matter is much divided, especially as regards the regulations which ought to govern the sale of the flesh of tuberculous animals. Some, but, as I believe, very few of those who are competent to form an opinion on the subject, share the views which are put forward in M. Butel's paper. I believe, however, that I am justified in saying that the majority of those who have specially worked at the subject have come to the conclusion that the resolutions passed by the International Veterinary Congress which met in Paris in 1889 were not justified by the evidence then available—at least, that is my own opinion on the matter. I number myself among those who think that the sale, or rather the consumption, of the flesh of tuberculous animals is in no important degree causally related with the great prevalence of tuberculosis in the human subject, and that the decision of the last Congress, so far as it exerted any effect on public opinion regarding the cause of tuberculosis in man, had an injurious influence. The great cause of tuberculosis in the human subject is not the consumption of the flesh of tuberculous animals, but the almost general neglect of those precautions which ought to be observed in order to prevent the infection of those who are brought into contact with tuberculous individuals of their own species.

Those who with M. Butel assert that bovine tuberculosis is a disease *totius substantiæ* base this opinion mainly on the experiments which have been made with the blood and muscle juice of tuberculous animals. In the paper which M. Butel has prepared for this Congress he cites a number of such experiments, and claims for them that, upon the whole, they indicate that, no matter what the extent of the lesions may be, the entire body of a tuberculous animal is dangerous. I must, however, point out that in coming to this conclusion M. Butel has overlooked one or two important considerations. In the first place he has laid himself open to the reproach of having omitted from the list of experiments which he cites several recent series which yielded results entirely opposed to the view that he wishes this Congress to adopt, such as the experiments by Professor Bang and myself. Further, M. Butel has omitted to point out that several of the experiments with positive results which he cites are of little or no value, partly because they were not carried out with the precautions necessary to prevent accidental infection, and partly because they were made with the blood or muscle juice of tuberculous guinea-pigs or rabbits. We ought not to be seriously asked to believe that because in tuberculosis of the guinea-pig or the rabbit the disease ordinarily soon becomes generalised, the same is the case for animals of the bovine species.

Fortunately, however, in endeavouring to decide whether the whole body is dangerous in bovine tuberculosis we have other material for guidance than that derived from experiments made with the blood and muscle juice, namely, that which is afforded by a study of the distribution of the lesions in bovine tuberculosis. Regarding this point there can be no dispute. By far the commonest seats of the disease are the lungs, and the bronchial, mediastinal, mesenteric, and pharyngeal lymphatic glands. Everyone will certainly admit that lesions develop in these organs because tubercle bacilli have there become arrested and developed, and it is a perfectly logical conclusion that the relative rarity of lesions in other parts, such as the spleen, the kidneys, the muscles, and the bones, is ascribable to the fact that tubercle bacilli are seldom carried into these parts or seldom multiply in them.

Since the last International Veterinary Congress a Royal Commission was appointed in Great Britain to investigate the relationship of animal tuberculosis to human health. This Commission not only took into consideration the already available material, but also carried out many experiments of its own, and its labours were carried on for a period of five years. It issued its Report in April of the present year, and the conclusions at which it has arrived are entirely opposed to the system of wholesale condemnation of tuberculous animals. The investigations and experiments conducted by the Commission convinced the members of it that tuberculous lesions are seldom found in the muscular system, and that when meat actually contaminated with tubercle bacilli is sold to the public such contamination has generally been brought about during the slaughtering and dressing of the carcase. The Commission therefore came to the conclusion that a large part of the flesh of tuberculous animals might be consumed without danger, provided the actually diseased parts were removed, and care taken to prevent contamination of the healthy parts in the slaughter-house. I hope that when the question is put to the vote the resolutions passed by the last Congress will not be confirmed.

The wholesale condemnation of tuberculous carcases is not demanded in the interests of public health, and at the present time it is in most European countries on economic grounds impossible.

M. Nocard.—The conclusions which M. Butel has just read, and which are to be submitted to the vote, are, as he has said, the outcome of an understanding; no other proof of that is necessary than the signatures which follow the resolution.

On the one hand we have M. Butel and others, who think that tuberculous flesh is really dangerous and always dangerous; on the other hand we have those who defend the opposite thesis—and I am one of them—who think that such flesh is not dangerous except in rare circumstances, and then only to a slight degree owing to the small number of bacilli present.

The understanding which has been arrived at is justified by the necessity of passing the resolutions by a large majority of the Congress, so that they may serve as a basis for decision by the various Governments. That is why I have associated myself with the proposition.

I do not believe that this is either the time or the place to go into all the experiments which justify these conclusions. Since the last International Veterinary Congress, of 1889, the experiments made almost everywhere have proved that tuberculous flesh is for the consumer much less dangerous than it was at first supposed to be—that flesh of which the juice will render certain animals tuberculous by inoculation into the peritoneum may be consumed with impunity and in considerable quantity by these same animals.

The whole world is prepared to admit that muscle is a medium unfavourable not only to the multiplication, but also to the conservation of the life of the bacillus, while in the mammary gland the bacillus finds a soil eminently

favourable for its multiplication and for the formation of centres of tuberculous affection.

In that lies the difference of gravity between tuberculous milk and tuberculous flesh.

This being admitted, I think that the Congress may with all safety support the propositions of M. Butel, with the earnest desire to protect the health of the public by avoiding even the shadow of danger which might result from the consumption of tuberculous flesh.

M. Trasbot.—I need not say anything in justification of the conclusions presented by M. Butel, since I have myself signed them, but I wish to call the attention of the Congress to two propositions which appear to me complementary, and of practical utility in the meantime, and until more radical measures with regard to tuberculosis have been taken.

Last week I was present at the reunion of veterinary practitioners at Lyons, where this question of tuberculosis has been long studied from the point of view of the inspection of meat, the seizure of tuberculous flesh, and the means to which one ought to have recourse to prevent the extension of this disease.

After very prolonged consideration two views were formulated, and these I shall now make known to you.

The documents which have been produced up to the present time, and to which it would be superfluous to add any more, result from two facts. The first is that the flesh of tuberculous animals may be virulent, and that on a good many occasions, as was mentioned a minute ago, tuberculosis has been communicated to experimental animals by inoculation with the muscle juice. The second fact is that injections made from the flesh of animals which were tuberculous only to a certain degree (not generalised) have remained harmless.

However, to be absolutely logical, since there is a possible danger of infection, one ought to absolutely proscribe, without reservation, the use of tuberculous flesh, since it follows from the facts that this flesh may communicate tuberculosis, although perhaps only rarely.

No person (here, at least, that must be recognised) dare adopt this radical conclusion. Everyone admits the necessity of a certain moderation—a middle course which would not oblige us, for example, to condemn the flesh of such animals as have, while alive, presented all the appearances of health—very fat animals, representing a very considerable value, and nevertheless in reality tuberculous.

We have, in France, administrative regulations, in virtue of which it is permitted to sell the flesh when the tuberculosis is very circumscribed, but condemnation is pronounced in the case of animals attacked with advanced tuberculosis.

Such is the general idea which ought to serve as a guide to practitioners. But some of these indications are susceptible of different interpretations, and in practice everyone does not act in the same manner. Some meat inspectors are very rigorous; others, on the contrary, are very tolerant. All practical men complain of this absence of a rule of conduct, and would be very glad to be provided with some fixed and precise guide as to what they ought to do in different cases. I will cite some examples.

Some time ago I was in a large French town—Amiens. For several years a meat inspector there had seized everything; the practice became established, and the butchers made no complaint. Elsewhere it was not possible to go so far as this, and there was cited the case of an inspector who found himself in presence of a fat cow which had some tubercles in the lung and on the left pleura. He condemned the left side of this animal and passed the rest of the carcase for consumption. He was accused and prosecuted for being too lenient, and the documents bearing on the case were submitted to

me for a report, with the result that I decided in favour of the accused (M. Nocard—Quite right!), just because he had not for his guidance any fixed rule, and therefore the duty of deciding when seizure ought to take place was left to the personal opinion of each.

It was then that the meeting of veterinary surgeons at Lyons, after having considered this question at length, passed a resolution, which might be added to the propositions formulated by M. Butel, in the following form:—

The Sixth International Veterinary Congress recommends that in each country a Commission ought to be charged with the duty of determining with precision in what cases inspectors ought to pass the flesh when the existence of tuberculosis has been established at the post-mortem of the animal.

It is certain that at the present time it would be well to have a uniform formula. Perhaps such a measure will become unnecessary in the future; I do not know. If tuberculosis becomes very rare, then by reason of the small number of animals to be condemned one might act with greater severity, but at the present time it is recognised that general slaughter would involve the Governments in such an outlay that no one would dare to propose this method of proceeding.

There is still another point to which I should like to call the attention of the Congress; it is the means of preventing fraud concerning the existence of the disease. I do not know what is done in other countries, but in France a project of law is being prepared with the object of combating the extension of this disease; this prescribes, for example, the amount of compensation when declarations are made after one has submitted the animals to the tuberculin test, etc. But there remains one point which must be cleared up, and that relates to the animals which are not suspected of being attacked with tuberculosis when they are brought to the slaughter-house, but are there recognised to be affected. At present the loss falls on the sellers if the animals are seized wholly or in part. It may happen that the seller has acted in perfect good faith, that he has not had the least suspicion of the existence of the disease, and then he is the innocent victim of a more or less considerable loss. All that may have the effect of leading the owners of tuberculous animals to do everything in their power to prevent the detection of the disease. It is a matter of public notoriety that in slaughter-houses where the inspection is carried out vigorously far fewer tuberculous animals are now killed than formerly. Through fear of seizure the owners sell their animals to butchers who slaughter on their own premises, where the disease passes undetected. When one puts a man in presence of his own interest and of regard for the law, he has always a tendency to strive by every possible means to evade the applications of the law; if, on the contrary, he has nothing whatever to lose by complete compliance with the law he will not be led to break it. It would therefore be well to regulate definitely and in a uniform manner this question of compensation, as that would be well calculated to make disappear, or at least to diminish, the danger which arises from the consumption of tuberculous flesh.

That is why I submit to the Congress a second proposition:—

Compensation for seizure will be awarded in every case in which there is no reason to doubt the good faith of the seller.

Such compensation ought to be equitable; that is the only means of preventing evasion of the law.

Professor Stockman.—When one considers the question of the total seizure of tuberculous flesh, one is struck with the inapplicability of the measures proposed.

We know that tuberculosis does not follow the same course in all species of animals. In some of them the bacilli have a tendency to remain localised, in others the blood, and consequently the organs, become invaded by these

microbes. One is not justified in saying that the results obtained by inoculating blood of one species are similar for all others. M. Butel has cited the positive results obtained in using blood from the human subject, the rabbit, and the pig—species which are often affected with generalised tuberculosis, but the numerous negative results obtained by inoculating with the blood of tuberculous cows have, from our point of view, a greater importance, butcher meat being principally derived from the ox.

Nor is it right to say that since the muscular tissue of one species has been shown virulent in a certain number of cases it will be the same and in the same proportion in others. The muscle juice of tuberculous pigs often contains bacilli, but that is not to say that the flesh of the ox is virulent to the same extent; the experiments by Nocard, M'Fadyean, and Leclainche furnish testimony to the contrary. These experiments were made with the juice expressed from some pounds of flesh, inoculated not in drops, but in cubic centimetres, and not to one guinea-pig, but to several. Some injections were made into the peritoneum, which is the most delicate method, because we know that a single bacillus introduced into the peritoneum may serve as the starting-point of tuberculosis, and in fact when one examines at the outset sections of tuberculous organs one finds only two or three bacilli in the points of cellular infiltration.

The negative results obtained in inoculating with muscle juice obtained from tuberculous cattle furnish a proof that the muscles of these animals rarely contain bacilli. If, on the contrary, positive results are obtained one may be certain that it is a case of accidental contamination or of an acute tuberculosis.

If in tuberculosis of the ox the blood always contains bacilli one ought to expect to find lesions in the organs susceptible of being infected. But how often have lesions been found in the spleen or heart of the ox? Almost never. And miliary tuberculosis not often. Even in a case of generalised tuberculosis it is exceptional to encounter tubercles in the muscular system. I have searched for them, and I have found them once only—in a pig.

Suppose that even in the half of tuberculous animals the disease is generalised, it is not necessary on that account to condemn the flesh of the other half if the inspection has been well made, for acute tuberculosis is very easy to recognise at the *post-mortem*; the inspectors might superintend disinfection.

It is said that we do not know when the disease has become generalised, but when we know that generalisation is exceptional in the ox, we ought to conclude that it has not taken place when we do not discover any trace of it.

I shall not say anything about infection by injection. I confine myself to expressing the opinion that tuberculous flesh may be consumed without danger.

HERR BEISSWÄNGER.—The eager participation in this discussion shows what great importance attaches to the question. In my opinion this question is beyond doubt the farthest-reaching and the most difficult of our programme. Far-reaching inasmuch as the veterinary meat inspector, in coming to a decision regarding tuberculous flesh, has to solve two problems of nearly equal importance. In the first place he has to take care that the health of the meat-consuming public is not exposed to danger, and in the second place he must avoid inflicting economic injury without sufficient grounds. In this Congress, which is mainly composed of veterinary surgeons, I believe it is necessary to give attention to both these considerations, and not simply to give expression to the purely scientific side with respect to the protection of human beings. The question before us is difficult, because, owing to the great variety of forms under which tuberculosis comes before us, it is eminently difficult to draw up distinct rules which shall fit all cases. I myself have recently had much to do with the drawing up of such regulations, and I must

admit that up to the present time I have not been quite successful; there has always been a large number of cases that would not fit into my list. It is, further, difficult to draw up definite regulations because, as the present discussion has clearly shown, there exists the utmost divergence of view with regard to the cardinal question. The cardinal question is this: Up to what stage of the disease may we assume that the flesh is not dangerous, and when does the danger begin? Here opinions regarding that are extraordinarily divided. Some incline to the view that the danger which lies in tuberculous flesh is very great, and that it is present even in commencing tuberculosis; others, and I include myself among them, are of the opinion that the danger to health is not so very great; and I entirely agree with Professor M'Fadyean when he says that experiments with guinea-pigs are not directly applicable to the case of the human subject. In North Germany, for example, a great deal of raw flesh and flesh from tuberculous animals is eaten, but so far as I can make out from the medical statistics cases of primary intestinal tuberculosis in human beings are very rare; that, certainly, would not be the case if the danger which lies in the use of tuberculous flesh were actually as great as some have represented it to be.

But the great practical necessity at the present time certainly is to lay down definite rules for our guidance. Practical veterinary surgeons from all countries, I believe, and certainly those from Germany, confidently expect and hope for a definite rule to guide them. The necessity for formulating definite rules for guidance has already been repeatedly mentioned, and, if I have rightly understood them, Professors Nocard and Trasbot are in favour of that. If we now consider the various motions we must regret that at least some of them were first put into our hands to-day; indeed, the resolution moved by M. Butel has not yet been printed. That is a circumstance which makes the matter still more difficult. I think that before coming to a decision on such a highly important question we ought to have sufficient time to thoroughly consider it and examine it in all directions. I myself, owing to the shortness of the time, am not able to criticise the resolutions put forward except in a superficial way. In the first place, there is the resolution by M. Butel, which in substance advocates the condemnation of flesh when it is suspected of being dangerous to human health. That is the cardinal point in this compromise recommendation, and certainly it does not fulfil the desire for the formulation of definite regulations on the subject. In this respect Herr Guillebeau's goes decidedly further, inasmuch as it says definitely that in countries in which the flesh is cooked it is under such circumstances to be passed, and in such others, on the contrary, to be confiscated. However, I can give expression to my objections to that—and they are of a serious nature—when the special debate comes on. Lastly, we have the de Jong resolution, which in general advocates sterilisation. That is good and practicable in large towns, but not outside of these in the country.

I am authorised to submit the following resolution on behalf of the fifteen gentlemen who have subscribed to it:—

Considering that in the question of the utilisation of tuberculous flesh, which is equally important from the point of view of hygiene and of economic interests, it has not been possible to publish in time the number of printed reports corresponding to the far-reaching importance of the question, the Congress refrains from formulating precise conclusions, and recommends that this subject be inscribed as a principal question in the programme of next Congress.

Signed by: Beisswänger, Albrecht, Edelmann, Foth, Hafner, Imminger, Kitt, Kleinschmidt, Koch, Lies, Mehrdorf, Postolka, Rudowsky, Schindelka, Schmutterer, Sperk.

I would not bring forward this motion if I could persuade Professor Trasbot to bring forward his resolution in an independent form, and not as an addition to that of M. Butel.

The PRESIDENT.—I beg of the speakers to be as brief as possible. I will allow each five minutes.

M. NOGUEIRA.—After having read the two reports by MM. Butel and Guillebeau, I subscribe entirely to the conclusions of the first of these gentlemen. But he has just told us of the transaction which has taken place, and in that transaction he has acted rather as the clever diplomatist than according to his own firm convictions.

I believe that we are concerning ourselves a little too much with the economic side of the question and not enough with the purely scientific side; but I will leave the consideration of that to those who are more competent than I am.

I ought to tell you that there is only one country where tuberculosis is the object of radical measures; that country is Portugal. Since 1886 we have had a sanitary law concerning contagious diseases, and that law was followed in 1889 by a regulation to the effect that all flesh coming from animals recognised as tuberculous at the *post-mortem* should be seized and destroyed.

This measure might appear to be of a nature calculated to raise strenuous protest on the part of the owner; such, however, has not been the case. We have about 900,000 cattle, of which five per cent are tuberculous. Our statistics are very well kept, and I earnestly wish that the other European nations would imitate this small country of Portugal.

M. Guillebeau says in his paper that the best means of combating tuberculosis consists in carefully collecting and destroying tuberculous sputum.

It seems to me from that that M. Guillebeau thinks that human tuberculosis is the special source of the same disease among animals. I ought to mention something which has happened in Portugal, and which proves the contrary.

We have nine different breeds of cattle. One of these is the breed of wild cattle which are used as in Spain for the bull fights. These animals, which are wild in every sense of the word, occupy the whole of the valley of the Tagus, over an area of twenty square leagues; they have no cultivated pasture and no buildings. They live in such a state of liberty that when, during winter, the Tagus overflows and covers the country where they are found, these animals, having no longer sufficient food, die of famine in large numbers. It is at that time that one is able to take them either to the slaughter-house or to the bull ring.

Now, of our nine breeds the one which occupies the highest place with respect to the prevalence of tuberculosis is the one which is used for milking purposes, and after that comes these wild cattle, with a proportion of 3·8 per cent. tuberculous.

How can man have contributed to render these animals tuberculous when he has never been in contact with them?

The PRESIDENT.—I repeat that each speaker must not exceed five minutes.

M. LANZILOTTI.—I accept the resolutions signed by M. Butel and others, but I wish to call your attention to the necessity of modifying them, namely, of sanctioning the sale of cooked flesh from tuberculous animals, provided the disease has not advanced too far.

I believe that the Germans will agree with me in this matter, for they are acquainted with the experiments which have been made at the abattoir of Berlin with the steam steriliser of Rohrbeck. The flesh cooked in this apparatus may be eaten without risk, and it has quite a good flavour. In this there lies a question of national economy. There is no need to remove from public use a large quantity of flesh which satisfies the requirements of public hygiene.

In Italy, since 1890, as in Germany, the regulations ordain that tuberculous flesh must be sold in the lower class shops, and that tuberculous flesh is to be sold in the cooked condition, either by steam or otherwise, as may be convenient.

I will move the following resolution:—

It is desirable that the flesh of tuberculous animals passed for consumption shall not be sold until after it has been sterilised by steam.

HERR SIGMUND.—Having been for twenty-five years chief meat inspector in a town of 85,000 inhabitants, I think that I am justified in saying a word or two on this subject. I may say that I was much pleased with Herr Beisswänger's remarks, with which I entirely agree. What he said denoted a man of practical experience. Only the last sentence, which advocates the postponement of the question till next Congress, is not to my liking; since the question is so weighty and pressing we ought to come to a decision to-day, although the meeting may have to last an hour longer. But there is still another thing in the report which I do not like, and that is the conditional passing of the raw tuberculous flesh; in my eyes it is objectionable. Either the flesh appears to us to be diseased, and then we ought not to pass it, or it appears to us to be not diseased, that is to say, not in a condition to carry danger to human health, and then we ought to pass it unconditionally. By passing the flesh conditionally we unjustifiably injure the agriculturist, and we at the same time do an injury to the consumer, since not everyone who purchases flesh at the Freibank, and reads that it must be cooked, eats that flesh himself and follows the directions. If he were to eat the uncooked flesh himself, then he himself would be responsible, but often it is his servant or those who board with him who eat it, and in certain circumstances in this way may become injured. The flesh is either not dangerous, and then can be passed unconditionally, or it is to be pronounced dangerous, and in that case to be sterilised. Why do we not pass the flesh of trichinous pigs with directions that the same is only to be eaten when cooked? Because we will not run a risk which at any hour of the day might become manifest. When anyone eats trichinous pork he becomes ill within a few days, and proof of the injury is thus afforded; on the other hand, when anyone eats tuberculous flesh and is thereby injured, the fact cannot be proved. There are so many circumstances in which human beings may contract tuberculosis that one cannot say that the disease was brought about by this flesh. The unconditional passing of tuberculous flesh is thus an injustice, and above that, it is immoral. We veterinary surgeons have to protect the poor no less than the rich; we belong to the people, and we must therefore say that what is not good enough for the rich shall not be eaten by the poor, and if we cannot say that the flesh is under all conditions safe, then the poor also should not eat it. I would say the same of the flesh which is in a high degree emaciated, and such flesh I would not allow to be sold, even in the sterilised condition, since the emaciated flesh of tuberculous animals is loathsome even when it is cooked; a transudate forms between the muscular bundles, and when such flesh is cut into it presents a nasty appearance. None of us would eat such flesh, and therefore we ought not to suggest to poor people that they may eat it; to do so would be unjust. I would like to formulate my opinions in three resolutions, although at the same time I subscribe to the other similar motions, and shall withdraw mine if Professor Trasbot's motion is passed.

1. *In cases of slight or local tuberculosis the flesh may be passed for consumption.* We have no right to confiscate this flesh.
2. *The flesh of animals that are tuberculous to a higher degree, but which do not betray any signs of general wasting, should only be passed for consumption in the sterilised condition.* This applies to the flesh which has not yet a bad aspect.

3. *The flesh of emaciated tuberculous animals is loathsome, and should be destroyed.* Here the loathsome character of the flesh is objectionable.

M. CHAUVEAU.—I am led to say some words by the last sentences in the communication made by our young *confrère* from Edinburgh, who expressed the view that the Congress should clearly decide that the muscular tissue is virulent to such a feeble degree as to render the danger of it absolutely insignificant. What would be the good of that? That is a question which has long ago been settled, and I may on this occasion remind you of my first experiments on the contagious nature of tuberculosis, going back as far as 1868-1870, and following those of M. Villemin.

As you know very well, I fed young animals of the bovine species with tuberculous matter either from the human subject or the ox. That was at the time when it was categorically affirmed that the muscular tissue did not contain the contagious element, which, at that period, was not known, but which I declared to be solid tangible particles. I stated that in a most categorical fashion, and I also affirmed that the virus—I did not say the bacillus—resided almost exclusively in the lesions produced by tuberculosis. Two years later I made some similar statements with regard to the milk, and two years after that I was glad to see Professor Bang demonstrate in such a lucid manner that the milk is not infectious unless it comes from a mammary gland actually attacked with tuberculosis. But in butcher meat there is more than muscular tissue. My opinion has always been that the flesh may either be infective or it may be so only to an extremely slight extent. Above everything, it is necessary to distrust the lymphatic glands. When you have in your hands a piece of butcher meat you expose yourself in eating it to being infected, if in the muscular tissue, tendons, connective tissue, etc., you find one or several glands in the interior of it. M. Nocard says with much reason that the bacilli at certain periods become developed and arrested in the predilection tissues, such as those of the abdomen and the bone marrow; but he has forgotten the glands in the interior of the muscles. It is incontestable—it is my own experience—that one finds diseased glands, capable of communicating tuberculosis, in animals which at the time of slaughter present the most excellent appearance. We know that the glands may be affected to a very slight extent, but I once communicated tuberculosis to two calves to which I had administered by the mouth an extremely small quantity of tuberculous material.

Here is another fact which has not yet been published. I found one day in a dog a lymphatic gland; it was infected to only a slight extent, for not more than five or six weeks. This gland was given to a pig, and the animal became tuberculous.

It is well to take into consideration not only the muscular tissue, which presents, it is true, a very feeble virulence, but also the lymphatic glands of the muscles. It is of perhaps not much importance to recall this particular to your recollection, as it is certainly known to each of you; but at the moment when you are about to come to an important resolution it is well to have before your mind that butcher meat is not composed exclusively of muscular tissue that is only feebly virulent, but also of lymphatic glands which may become a cause of contagion for the human species.

M. LAURENT.—With regard to the subject of tuberculosis I will as an ordinary practitioner cite a fact.

I inoculated a guinea-pig with liquid taken from the chest of a soldier, twenty-one years of age, and dead of phthisis in the hospital. At the same time I inoculated a rabbit with material taken from a centre of suppuration in the muscle of one of the thighs of this same soldier. Forty days after inoculation the guinea-pig died completely tuberculous, and I called in two military doctors who were then at Bar-le-Duc to make the *post-mortem* of it;

both of these recognised the lesions of a generalised tuberculosis, but the rabbit which had been inoculated with muscle juice proved to be perfectly healthy, and I went so far as to eat it.

I believe, therefore, that there is no danger except when the tuberculosis is generalised in the muscles, as has been very well said by our eminent colleague, M. Nocard. Now, for thirty years I have been meat inspector at Bar-le-Duc, and I have never seen tubercles in the muscles. It does not appear to me to be necessary to take Draconian measures against the flesh of tuberculous animals, but only in the case of emaciated animals that are tuberculous to the last degree. I will move the following resolutions:—

1. *That all private slaughter-houses should be abolished.*
2. *That these ought to be replaced by district slaughter-houses, in which the inspection should be carried out exclusively by veterinary surgeons.*
3. *That the flesh of fat tuberculous animals may be passed for consumption with or without sterilisation according to the case, with the exception of the thoracic and abdominal viscera.*

HERR LYDTIN.—Most of the previous speakers have supported M. Butel's motion. It is true that Herr Sigmund has put forward a resolution which differs from that of M. Butel, inasmuch as he is in favour of the flesh of animals that are tuberculous in a certain degree being sold, not in the raw, but only in the cooked condition. Opposed to that, however, we have the motion by Herr Beisswänger and others, which is practically to the effect that we ought not to-day to come to a decision, because the matter is not yet ripe, and that we ought to refer it to the next Congress, which will be held in five or ten years.

I would like, in the first place, to observe in reference to that, that this motion can be justified only on the ground that we are not in a position to know whether tuberculous flesh is injurious or not, and especially because we are not able to make different categories for the flesh, such as harmless, doubtful, and distinctly dangerous. That strongly reminds me of the controversy with regard to pleuro-pneumonia: there also many speakers have said, also in international congresses, that we could not combat pleuro-pneumonia through slaughter or any other method since we did not know whence it arose, and since it could develop from all possible causes. It is not yet thirty years since this method of reasoning was applied to the case of pleuro-pneumonia; here, again, it is the same. I would observe, however, that until the end of last century in all civilised countries tuberculous flesh was entirely excluded from consumption, and indeed this flesh was held in such abhorrence that it was the duty of the butcher to do away with even the utensils used for slaughtering the animal.

It is only a hundred years since Graumann, a physician of Mecklenburg, proved how unfounded this fear of the danger of tuberculous flesh was, and in order to prove that such flesh was not injurious he had tubercle nodules cooked in the open market at Mecklenburg, and then consumed the same before the whole people. From that time onwards the sale of tuberculous flesh was gradually permitted, and this was even carried so far in many countries that no attention whatever was paid to such flesh. But as early as the middle of the present century regulations against tuberculous flesh were again introduced, and since Koch's discovery you know that a very strong movement against tuberculous flesh has made itself felt throughout the civilised world. We certainly cannot say that all tuberculous flesh is dangerous to health; that we must certainly and openly admit, and it may be entered in our minutes. But we have heard from a distinguished authority that infection may result from the ingestion of tuberculous flesh by animals, and we must conclude from that that the same is the case with human beings, although rarely. I quite agree with Herr

Sigmund when he says that not only the flesh which contains the virus is injurious to health, but also the loathsome flesh. When you bring the flesh of a tuberculous animal into the market, and you tell the people who have consumed it that they have eaten flesh from a tuberculous animal, what will these people (and they need not be very sensitive) reply to you, and what will they say of a meat inspection which permits of the sale of such flesh? With reference to that I will observe that Robert Koch, at a meeting of the Imperial Board of Health at which I was present, asserted that all flesh of a loathsome character ought to be regarded as dangerous to health, and especially that derived from animals which were the subjects of infectious diseases; and if I express the same opinion publicly, I can appeal to the authority of one who has a European reputation, and whose position as a thinker cannot be over-estimated. If we now declare that we are not competent to decide the question because we are not mathematically sure about it, that is right enough, but can we mathematically solve the simplest question in veterinary science. And what would happen then? Then it is said, in the next place, "the Congress which met in Paris and the one which met in Brussels came to a wrong conclusion." But there is certainly nothing in that, for I regard a Congress as a man, and every man may err—*errare humanum est;* but on the ground of these conclusions, and on the ground of an old custom, most civilised States have issued laws and orders, and certain qualities of tuberculous flesh have been excluded from public sale. These legal prescriptions have been issued, and now comes the Berne Congress, and says, "We are not able to declare whether there is a danger in the use of tuberculous flesh or not." Thereby we should shake not only what has been determined by law, and what exists for the good of the general public, but we should also completely shake the confidence in our science. Such a conclusion would destroy the authority of this Congress, and also the authority of veterinary science.

HERR EDELMANN.—I should like to say only a few words regarding the consequences which might follow from a resolution that the flesh of all tuberculous animals should be submitted to sterilisation (a voice: That will certainly never be done!). It may perhaps cause those who are in favour of this proceeding to hesitate when they hear some figures regarding the spread of tuberculosis. I would like to cite to you some figures regarding meat inspection in the kingdom of Saxony for the year 1893. We have meat inspection in twenty towns, and in the year 1893, 69,000 cattle were slaughtered; of these about 12,000 head, or 18 per cent., were tuberculous. Of these tuberculous animals we have passed about 90 per cent. unconditionally; over 5 per cent. we sent to the Freibank, and over 4 per cent. we have completely destroyed. Now, if all the flesh of tuberculous animals had to be sterilised, we should have had to sterilise the flesh of about 12,000 animals, and this would have meant a very considerable national loss, for experience shows that through sterilisation the value of the flesh is depreciated from 40 to 60 per cent. Besides, there arises the question whether sale could be found for such flesh; in large towns that might certainly be the case, but in the country it is very difficult. I would mention further that in Saxony only about 3 per cent. of all the cattle slaughtered are submitted to meat inspection. If such inspection were made general, the figures would be proportionally increased, and the consequent loss would be still more important. I therefore do not think that the Congress ought to adopt the view of some of those who have contributed papers on this subject, and make sterilisation obligatory.

I would like also to recall the fact which has been put forward from the scientific side, that the danger is not so very great, and I think it would therefore be well not to push all the conclusions in that direction too far, lest

they cause those governments which wish to introduce meat inspection to postpone that, and lest the passing of such Draconian regulations should frighten them from generalising meat inspection. That might very well happen if the danger of tuberculosis were here represented to be greater than it actually is, and if such exaggeration found expression in our conclusions.

M. STAVRESCO.—A young veterinary surgeon like myself is perhaps not competent to engage in the discussion of a question of such high importance as this. At the same time I should like to say that in our country all the veterinary surgeons do their utmost to bring about the seizure of tuberculous flesh.

The question as it has been put before us appears to have in view two things, namely, first, public economy, and, second, public health. Sometimes, if not frequently, it is the economic side that predominates, and sometimes the contrary happens. We are not yet clear regarding the transmission of animal tuberculosis to the human species; as long as this doubt subsists will anyone dare to come to a positive opinion? Some experimenters of a certain age say that it would be better to pass for consumption the flesh that does not present any tuberculous lesions. I would like to put to them one question: Would they venture to give to their own children the flesh which comes from a tuberculous animal? (M. Nocard and several others: Certainly). I believe that it is prudent to abstain from doing so, and as I look upon all the world as brothers, I cannot refrain from asking you to vote against the consumption of tuberculous flesh in any form.

M. MOROT.—Tuberculous flesh that has been sterilised with a view to its more or less immediate consumption alters very quickly if it is not promptly sold, and hence it escapes seizure on account of tuberculosis only to be confiscated on account of its being spoiled, in localities where it is offered in excess of the demand. Besides, many people do not like this flesh sold in a special place; they regard it as suspected because it is not sold in an ordinary butcher's shop.

For all these reasons the sale of sterilised flesh from tuberculous animals ought to be greatly increased, by assuring that it shall keep well, by giving it an unlimited facility of circulation, and by introducing it into all the shops where alimentary matters are sold.

A proceeding which I indicated in 1891 gives complete satisfaction in this respect. It consists in transforming the flesh of tuberculous animals into extracts or conserves after prolonged boiling, preceded by the removal of the manifestly diseased parts and those immediately around them. Such boxes of conserves or extracts would be readily bought if they were marked in plain and indelible characters with an inscription of the exact nature and innocuous character of their contents, and if, above all, they were sold in the ordinary shops along with other alimentary commodities.

Although the muscular tissue properly so-called may rarely be dangerous, it is necessary to take into consideration the danger of the lymphatic glands, which are sold together with the muscular tissue in the shops. That is why it is necessary to impose sterilisation in the case of certain tuberculous animals. I say *certain*, and not *all*. It must not be forgotten that in cattle with tubercles in the lungs, but without any on the inner aspect of the pleura covering the chest wall, tuberculous lymphatic glands often exist under the triangularis sterni (inspector's gland of Van Herzen), and also at the entrance to the chest. Moreover, very extensive or generalised tuberculosis of the lymphatic glands is often but little apparent, on account of the concealed position of the glands attacked, and because of the absence or slight intensity of the tuberculous lesions in other organs. At Troyes, at the beginning of the present year, I seized a splendid bull of which the prethoracic, prescapular, suprasternal, subdorsal, sublumbar, precrural, iliac, and popliteal glands were abundantly

infiltrated with tuberculosis. There were only a few tubercles in the interior of the lung, and none were seen on the parietal pleura or peritoneum.

M. STUBBE.—At the International Congress of 1889 it was decided almost unanimously that the flesh coming from tuberculous animals, no matter what the extent of the disease, ought to be excluded from consumption. I myself, along with many other Belgian *confrères*, voted for this proposition. In consequence of this vote of the Congress, the Belgian Government organised in 1891, in virtue of a law on the falsification of food commodities, a regulation of extreme severity, ordaining the seizure of tuberculous flesh. When the disease was generalised in one organ—the lungs, for example—the flesh had to be condemned.

The application of this regulation, issued under Royal decree, encountered very great difficulties in practice, especially in consequence of the experiments made by M. Galtier, professor at Lyons, and others, who demonstrated that the Paris Congress had gone too far in its conclusions. The muscle juice taken from a patient phthisical to the last degree when injected into guinea-pigs weighing not more than a pound, or to rabbits of a kilogramme, conveyed the disease; but negative results followed the administration by the mouth of flesh coming from animals that were tuberculous when slaughtered. One had then to diminish the rigour of the Royal decree.

And I am very glad to learn that M. Butel has also in the same sense rectified his conclusions.

I shall have pleasure in supporting the conclusions which have been put before us, while reserving the right to propose some slight amendments.

The Honourable M. Lanzilotti is in favour of having tuberculous flesh, whatever may be the degree of infection, sold in the cooked condition; that is not possible. (M. Nocard—No.)

We are in agreement so far as that relates to the flesh in cases of generalised tuberculosis, but to do that in the case of animals attacked with local tuberculosis would be to inflict an injury on agriculture without motive.

HERR BEISSWÄNGER.—I should like to make a short explanation, as apparently I have been entirely misunderstood. I never intended to deny the dangerous nature of tuberculous flesh; I have only said that I belonged to those who hold that the danger is not very great, and the same opinion has from this place been expressed by several other gentlemen. Besides, with the fifteen members who have subscribed my motion, I was decidedly of the opinion that, since we are not to-day in the position to come to a complete agreement as to what ought to be substituted for the conclusions of the Paris Congress, it would be better to leave the thing alone. Moreover, I am ready to withdraw my motion in favour of that of Professor Trasbot since one of my friends has spoken with him on the subject. I would like, further, to explain that all my friends who have placed their signature along with mine are opposed to all the resolutions with the exception of that of Professor Trasbot.

The PRESIDENT.—The general discussion is now closed. In order to arrive at a result we ought to proceed with order, so that we may all understand the same points. It would be a pity to separate without having advanced at least a step the chariot of tuberculosis, which we have dragged laboriously and for such a long time, like a ball rivetted to our feet. Those who have contributed papers will now say some words in reply.

M. DE JONG.—I think that M. Edelmann has not correctly understood me when he says that I wish sterilisation in the large towns only, and not in the country. On the contrary, I wish it everywhere and in all cases, that is when the flesh seized has a value exceeding the cost of sterilisation. M. Edelmann has represented that I wish everything to be sterilised; that is not the case, and no person has proposed that. The propositions which I have handed in to

the Secretary will sufficiently explain my manner of view. The seizure of the flesh of tuberculous animals, however desirable, is not practicable in view of the considerable capital which would thereby be destroyed.

I am thus almost in agreement with M. Butel, but I think that he enters too much into particulars. It is dangerous to trench on the individual opinions of our fellows; it is on that account that I recommend you to adopt a more general conclusion.

M. GUILLEBEAU.—My great desire for conciliation would suggest to me the idea of rallying either to the propositions of M. Butel or to those of M. Trasbot. I regret, however, that that is not possible. Why? Because both these gentlemen search for the limits which separate the doubtful from the semi-injurious, and from that which is not injurious at all.

I endeavoured to show you this morning that these limits cannot be found; to endeavour to separate that which contains the bacillus from that which does not contain it is to undertake the problem of squaring the circle.

One thing only causes me uneasiness; I read in No. 2:—"If these measures incur seizure, equitable compensation will be accorded to the owners." In the notes which I have taken of M. Nocard's speech I see that for him also the question of compensation plays a considerable *rôle*, but are we here to protect the health of human beings or to protect their purses? Have we to pronounce on this dilemma: The purse or the bacillus? (M. Hutyra—On both!). In reading these conclusions one foresees that the inspection would be badly done if equitable compensation were not granted.

Is that really the way in which we should lay down measures of such extreme gravity? To make the good of humanity depend upon a mere question of money is not possible.

The President has said that we ought to strive in this Congress to advance the question of using tuberculous flesh at least a step; that is a modest request.

The motions which have been proposed to you unfortunately remind me of this couplet from the opera:—

C'était pas la peine
C'était pas la peine
Assurément
De changer de gouvernement.

These motions do not offer anything new, and speak of things which are known throughout the world. I therefore maintain my own conclusions.

M. BUTEL.—I believe that you must be tired with the general discussion, and I shall not therefore detain you more than a minute; that is a promise that I shall not break.

Someone has said to me, "You have acted as a clever diplomatist, you have negotiated regarding your own convictions," and that is right.

My profound and intimate conviction is that all tuberculous flesh, without exception, whether it be the case of a single lymphatic gland or a tuberculous nucleus the size of a pin's head, ought to be excluded from consumption, because the animal which carries such small lesions may become a source of danger to public hygiene.

But the question of bacillus or purse is not the only dilemma; there is not merely the obligation to take one side or the other. We are still obliged to reckon with facts, that is to say, with the number of tuberculous animals which in certain countries or regions constitute a proportion of fifty per cent. of the total number of animals.

We are threatened by a great danger. I am for the moment obliged to negotiate, but on the day when cattle will have been decimated to such a degree that it will be impossible to close one's eyes on the veritable cause of an aggravation of the economic and hygienic situation, on that day you will find me ready to defend before the Congress the necessity of total seizure.

M. Stubbe.—By that day you will have made other experiments which will prove the contrary.

M. Butel.—I wait for these experiments. Up to the present those which have been made have only led us to negative results, and we persist in saying that tuberculous flesh is dangerous.

M. Stubbe.—Prove it!

M. Butel.—(1.) When one goes into an abattoir and there observes what takes place in the slaughtering and dressing of an animal, when one thinks that this pleura or that lung containing some tubercles are cleansed with a cloth which is afterwards applied all over the carcase, I say in that is to be sought the principal cause of the infection of healthy flesh.

(2.) The lymphatic glands may be so small as to pass undetected without the aid of the microscope.

At Lyons authority was appealed to, to settle whether a particular sample of flesh contained tubercles. A gland was taken and examined with the naked eye, which did not reveal the presence of any tubercles; but this gland, after having been crushed, was given to healthy animals, and these became tuberculous.

M. Nocard.—Then you eat the lymphatic glands?

M. Butel.—I am obliged to do so when I eat a piece of flesh which contains them.

(3.) There remain the bacilli of the circulatory system; these are less dangerous. As M. Nocard has demonstrated, they are very rapidly destroyed in the muscular tissue.

It nevertheless remains true that the tuberculous animal is dangerous, that it is necessary everywhere to practise total seizure, but that this measure is impracticable in view of the large interests which are involved.

The President.—It is very difficult to classify the resolutions which have been proposed; several offer notable differences. However, I believe that I may propose to you the adoption of a first article or a general fundamental conclusion. Do you wish to take action with regard to this question, or do you not? Do you wish to propose to the various Governments to take measures or not? I think that in this way we might embrace the circle of collective resolution sent in to the Secretary. We might in this way rally to one very general proposition which would permit us to make one step more in advance. Such a resolution would run as follows:—

The Sixth International Veterinary Congress calls the attention of the various States which are officially represented at it to the necessity of introducing a general obligatory inspection of meat.

On being put to the vote this proposition was unanimously adopted.

The President.—Now that the first motion of a general nature has been unanimously adopted, we shall deal with the others in succession, and select especially those which have a practical tendency. Here is a motion which, I think, may be adopted, if not by all, at least by the generality of you.

The flesh of tuberculous animals ought to be submitted to special regulations.

This proposition was unanimously adopted.

The President.—The next proposition runs as follows:—

If these measures entail seizure equitable compensation will be accorded to the owners.

M. Nocard.—I wish to make a distinction between the owners of animals the flesh of which is seized, according as they have or have not conformed to the regulations regarding tuberculous animals, or otherwise we shall have no reason for taking such measures; compensation ought to be accorded only to those who have conformed to the regulations.

M. Lydtin.—That is a detail!

M. Nocard.—Pardon me, that is not a detail, as I shall show you.

During the two years and a half for which the principle has been very slightly applied in Belgium, considerable sums have been expended in compensation, without advancing a single step the sanitary police or the prophylaxis of tuberculosis. Why? Because every proprietor is compensated; if they had made the distinction of which I speak the results would have been different.

M. BUTEL.—I not only accept the amendment by M. Nocard, but I will add that I was in absolute agreement with the view that owners who do not submit to the sanitary regulations of their country ought to be excluded from the privilege of compensation.

I believe with M. Nocard, that if we make a bad use of the resources at our disposal under this sanitary regulation, very grave inconveniences will follow.

I shall therefore propose:—

If these measures entail seizure equitable compensation will be accorded to the owners, on condition, however, that they shall have conformed to the law.

M. NOGUEIRA.—And the notification of the disease? How is that to be done?

The PRESIDENT.—I wish to point out to M. Trasbot that he has made a proposition entirely in conformity with one of those by M. Butel.

M. TRASBOT.—A word of explanation. The object in view is to prevent fraud; we are all agreed about that. But consider the case of a breeder whose stock is very important; he sends to the butcher a fat cow, regarding which he has never entertained any suspicion; this cow is found to be tuberculous, and it is seized. It is evident that the owner has not broken the law, and he has acted in good faith; that is why I add as a corrective: "*in order to prevent every kind of fraud.*" We must not be under any illusion in this matter. When a man is placed in a position in which he has to decide between his own interest and the general interest—in presence of the law, which he ought to respect and obey, he infallibly inclines to the side of his own interest. In order that he may not have any interest to act fraudulently, and to conceal the existence of tuberculosis, I say that the compensation is to be accorded to him *when there is no doubt as to his having acted in good faith.* This, of course, will not apply to the case of a dealer who has sold to the butcher animals that he knows to be tuberculous. I therefore adhere to my proposition.

The PRESIDENT.—My business is to simplify and to unify. I do not see why we should trouble about a word when it is easy to put two to make the idea clear.

M. TRASBOT.—I should like to go a step further, and to say that compensation should be accorded in every case where the good faith of the seller is not doubted.

M. MALM.—Who would decide the good faith?

M. CHAUVEAU.—At the present moment we have not to concern ourselves with the sincerity of the owners, but with the object to be obtained, which is that owners who have tuberculous animals ought to notify the fact. M. Trasbot wishes to make a reservation in favour of the owner who does not suspect the existence of the disease. If he does not *suspect* it that means that he does not *wish* to know the existence of this disease. At the present time when one wishes to sell animals, and at the same time to avoid the inconvenience of having them seized, one only needs to employ all the known methods to obtain assurance regarding the state of health of the animal.

The PRESIDENT.—We must now vote on the following proposition:—

If these measures entail seizure equitable compensation will be accorded to the owners on condition that they shall have conformed to the law.

M. LAURENT.—When a farmer wishes to sell an animal he ought to know perfectly well what to trust to regarding the state of its health.

The above-mentioned resolution was adopted by a great majority, only three voting against it.

The PRESIDENT.—The next proposition reads as follows:—

Seizure will be practised when the tuberculous lesions, from their extent or character, render the flesh suspected of being hurtful.

HERR LYDTIN.—For the information of those who did not take part in the Congresses of Brussels and Paris, might I add that the former resolutions of international veterinary congresses have condemned all flesh derived from tuberculous animals, and that therefore the motions now submitted constitute a very material concession to the advocates of the economic side of the question, as well as to public opinion in general.

The PRESIDENT.—I am well aware that at the Congresses of Paris and Brussels all tuberculous flesh was excluded from consumption. We must, however, remember that the introduction of a more moderate course is here a practical necessity, and only those who have never actually been engaged in meat inspection can ignore this necessity.

The proposition was carried by eighty-nine votes against eight.

The PRESIDENT.—It may be of some advantage to our practical colleagues to have an indication of the manner of proceeding. The remaining motions are as follows:—

The flesh seized shall be excluded from consumption:—

(a) *If it comes from an emaciated animal.*
(b) *If it presents a bad appearance.*
(c) *If lesions are present in the muscular system.*
(d) *If important lesions are present in other organs.*

M. NOCARD.—Several members cannot accept clause (d); I therefore demand a vote on each clause separately.

Clause (a) was adopted unanimously.

M. HUTYRA.—What is meant by a bad appearance?

M. STUBBE.—I propose to suppress paragraph (b).

The PRESIDENT.—The vote will decide that.

On being put to the vote, clause (b) was adopted by fifty votes against five.

With reference to clause (c), several members asked what was to be understood by "important lesions," but on being put to the vote this clause was adopted unanimously.

Clause (d) was adopted by seventy-one votes against eighteen.

The PRESIDENT.—The next proposition reads as follows:—

It is desirable that when the flesh of tuberculous animals is considered fit for consumption it ought not to be exposed for sale except in special shops, and with a declaration indicating its source, or after it has been submitted to efficient sterilisation.

This proposition was carried by fifty-seven votes against thirty-five.

The PRESIDENT.—The next proposition reads:—

The Congress records its opinion that the various Governments should promote as far as possible the erection of apparatus for the sterilisation of tuberculous flesh.

Passed unanimously.

The PRESIDENT.—Up to the present we have been voting on the propositions of M. Butel and those who are in agreement with him. Another proposition is that of M. Trasbot, and it is in these words:—

The Congress records its opinion that in each country a commission ought to be appointed to determine with precision in what cases the inspectors of abattoirs and private slaughter-houses ought to pass the entire carcase, or seize it in part or entirely, when the existence of tuberculosis has been discovered at the autopsy of the animal.

This proposition was adopted by eighty votes against eight.

The PRESIDENT.—A proposition by M. Lanzilotti reads:—

When the flesh of tuberculous animals is passed for consumption it shall not be exposed for sale until after it has been sterilised by steam.

M. NOCARD.—M. Butel's proposition leaves a certain limit to the State. He says, "*It will be desirable,*" but I do not agree with that. That of M. Lanzilotti is imperative. But I would ask those of our colleagues who were present at the *post-mortem* examinations held the other day at the Veterinary School whether they can adopt it. Out of one hundred animals denounced as tuberculous, fifty or sixty at least did not offer lesions more advanced than those which we found. Why, then, cook the whole of this flesh? That would be to diminish the value of it. I am entirely opposed to M. Lanzilotti's motion.

The PRESIDENT.—An explanation is necessary.

M. LANZILOTTI made an explanation which was imperfectly heard owing to the noise in the room. He was understood to say that the experiments made in Italy were conclusive. The measures taken there had given satisfaction. The cooked tuberculous flesh was sold in normal conditions.

The PRESIDENT.—I think there is no need to vote on this point.

M. STUBBE.—No, we have voted the contrary.

The PRESIDENT.—However, I have no objection if M. Lanzilotti insists.

HERR HUTYRA.—Only two words on a point of order. M. Lanzilotti's motion is in contradiction with one already adopted; it, therefore, cannot be voted upon.

The proposition was not put to the vote.

HERR SIGMUND.—I also have put forward a motion. However, since Professor Trasbot's resolution has been adopted, I withdraw mine in favour of his.

The PRESIDENT.—We have done well, and might be content with these resolutions. However, my colleague, M. Guillebeau, wishes to propose still another.

M. GUILLEBEAU.—I should be glad if the Congress would pronounce yes or no regarding the last of my propositions distributed. I have modified it slightly to read as follows:—

In order to prevent the spread of tuberculosis among cattle, it is important to collect in the byres the sputa of tuberculous human beings.

HERR HUTYRA.—I must object to a vote being taken on this resolution, since we have at the present time nothing to do with the spread of tuberculosis; nothing regarding that stands on the programme of the day.

M. GUILLEBEAU.—M. Hutyra raises a question of order. If you do not wish to vote that is your affair.

The PRESIDENT.—Professor Guillebeau has demanded a vote on this subject because it is in this chapter we might re-enter his remarks.

M. NOCARD.—M. Guillebeau has placed us in a rather difficult position. We are to be compelled to vote on a resolution which distinguishes between different kinds of phthisical sputa, but in our eyes it implies that the sputa of phthisical cowmen plays an important *rôle* in the propagation of tuberculosis, which nobody believes. It would be deceiving owners to lead them to believe such a thing. The cause of the disease ought to be attributed to the introduction of a tuberculous animal into the byres and not to tuberculous cowmen.

M. GUILLEBEAU.—I adhere to my proposition.

The PRESIDENT.—Does the Congress wish to vote on the proposition of M. Guillebeau?

(Cries of No! No!).

M. Guillebeau's resolution was not put to the vote.

This brought the discussion to a close.

ROYAL VETERINARY COLLEGE, LONDON.

LIST OF BURSARIES, MEDALS, HONOUR CERTIFICATES, ETC., 1895-96.

Coleman Prizes.

Silver Medal . . .	F. A. Verney. P. S. Howard.
Bronze Medal	W. Browning.

Centenary Prizes.

(*£20 each.*)

Class A	C. E. Steel.
Class B	T. Wolsey.
Class C	F. A. Verney.
Class D	J. T. Thurston.

CLASS PRIZES.

Class C.

VETERINARY MEDICINE—*Silver Medal*—F. A. Verney. *Bronze Medal*—S. Woodward. *First-Class Honour Certificates*—W. J. Browning, P. S. Howard, A. Maynard. *Second-Class Honour Certificates*—F. G. Liddle, W. M. Power, C. W. Stanley, F. T. Trewin, C. E. Wells.

MATERIA MEDICA—*Silver Medal*—F. A. Verney. *Bronze Medal*—A. J. Hines. *First-Class Honour Certificates*—S. T. Amos, W. J. Browning, J. B. Collyer, P. M. Evershed, R. W. Hall, A. F. Harber, P. S. Howard, W. H. Hirst, C. E. Perry, C. W. B. Sikes, J. T. Thurston, F. T. Walder, C. E. Wells, S. Woodward, S. B. Woollatt. *Second-Class Honour Certificates*—W. H. Brown, F. C. Gillard, P. E. Hoyland, G. H. Kitchen, P. Lloyd, W. C. Lowe, A. Maynard, A. Olver, W. M. Power, F. T. Trewin, W. G. Taylor, B. E. Wooster, R. Wood.

SURGERY—*Silver Medal*—A. Maynard. *Bronze Medal*—F. A. Verney. *First-Class Honour Certificate*—W. J. Browning. *Second-Class Honour Certificates*—P. S. Howard, W. C. Lowe, F. T. Trewin, S. Woodward.

PATHOLOGY—*Silver Medal*—T. J. Thurston. *Bronze Medal*—F. A. Verney. *First-Class Honour Certificates*—P. M. Evershed, P. S. Howard, A. F. Harber, A. J. Hines, R. W. Hall, C. W. B. Sikes, S. B. Woollatt. *Second-Class Honour Certificates*—S. T. Amos, W. H. Brown, W. J. Browning, J. B. Collyer, F. C. Gillard, W. H. Hirst, P. Lloyd, A. Maynard, C. E. Perry, F. T. Trewin, W. G. Taylor, F. T. Walder, C. E. Wells, S. Woodward, B. E. Wooster.

Class B.

ANATOMY—*Silver Medal*—T. Wolsey. *Bronze Medal*—C. Radway. *Second-Class Honour Certificate*—W. Cranston.

HISTOLOGY—*Silver Medal*—T. Wolsey. *Bronze Medal*—C. Radway. *First-Class Honour Certificates*—W. Cranston, E. Peacey. *Second-Class Honour Certificates*—C. W. Abrams, E. A. Batt, D. Chalmers, J. F. Jewell, P. J. Simpson.

PHYSIOLOGY—*Silver Medal*—C. Radway and T. Wolsey (æq.). *Bronze Medal*—E. Peacey. *Second-Class Honour Certificates*—W. Cranston, H. Gamble.

Class A.

PRACTICAL CHEMISTRY—*Silver Medal*—C. Roberts. *Bronze Medal*—H. Burrell.

CHEMISTRY AND TOXICOLOGY—*Silver Medal*—C. E. Steel. *Bronze Medal*—G. H. Wooldridge. *First-Class Honour Certificates*—H. G. Allen, G. T. Jackson, W. Lawson, G. Lockwood, J. M. Tate. *Second-Class Honour Certificates*—A. M. Brodie, H. Burrell, J. Cane, H. H. Jeffries, H. E. Hutchinson, J. Lee, H. S. Mosley, F. E. Mason, W. R. Neale, A. L. Purdy, C. Roberts, C. E. Rix, E. L. Siddall, J. J. B. Tapley.

BIOLOGY—*Silver Medal*—G. H. Wooldridge. *Bronze Medal*—W. Lawson. *First-Class Honour Certificates*—C. E. Steel, J. M. Tate. *Second-Class Honour Certificates*—H. G. Allan, A. M. Brodie, H. Burrell, H. E. Hutchinson, G. T. Jackson, H. H. Jeffries, J. Lee, G. Lockwood, H. S. Mosley, J. C. Munby, W. R. Neale, A. L. Purdy, C. Roberts, C. E. Rix, J. J. B. Tapley.

MINOR ANATOMY—*Silver Medal*—G. Lockwood. *Bronze Medal*—G. H. Wooldridge. *Second-Class Honour Certificates*—H. G. Allen, A. M. Brodie, H. E. Hutchinson, G. T. Jackson, H. H. Jeffries, W. Lawson, W. R. Neale, C. E. Steel, J. J. B. Tapley, J. M. Tate.

PASS LIST.

The following are the Pass Lists[1] of this Institution for Session 1895-96.

FIRST PROFESSIONAL EXAMINATION.

Messrs H. B. Elphick, H. W. Fernandes, F. H. Ingersoll, C. H. Jolliffe, J. P. Stableforth, D. S. Dickman, G. V. M'Naboe, R. B. Mearman, J. M'Wharrie, J. H. Poles, † H. G. Allen, * A. M. Brodie, * H. Burrell, F. W. Cousens, * C. H. Coombe, J. Cane, C. R. Copp, T. Haigh, H. H. Jeffries, G. T. Jackson, B. L. Lake, † W. Lawson, * G. Lockwood, J. Lee, * J. C. Munby, W. R. Neale, A. L. Purdy, C. E. Rix, * C. Roberts, D. H. Rail, * E. L. Siddall, * J. M. Tate, * J. J. B. Tapley, † G. H. Wooldridge.

SECOND PROFESSIONAL EXAMINATION.

Messrs E. Fenner, † W. G. Green, R. C. Cochrane, * E. T. Ensor, F. C. Hobbs, A. S. Head, * H. Mitton, C. J. Sanderson, G. P. Knott, * C. M. Park, J. B. Walker, † W. M. Williams, B. Young, A. F. Deacon, C. D. Stewart, A. N. Swanston, T. Elliot, J. W. Oakley, W. H. Anderson, R. W. Carless, J. Chalmers, A. Hudson, E. T. Goodall, S. G. Chellew, R. S. Collihole, J. F. Jewell, * C. W. Abrams, O. S. Fisher, H. Gamble, E. Peacey, † C. Radway, P. W. Smith, T. J. Symes, * H. A. Woodruff, C. M. Sharpe, * P. J. Simpson, † E. E. Batt, D. Crole, * A. H. Corry, D. Chalmers, W. Cranston, † T. Wolsey, * A. Whicher, * W. R. Williams.

THIRD PROFESSIONAL EXAMINATION (Four Years Course).

Messrs S. T. Amos, F. Crowhurst, J. B. Collier, P. M. Evershed, H. Gillard, F. Harber, A. J. Hines, * R. W. Hall, W. H. Hirst, G. H. Kitchen, P. Lloyd, A. Miller, A. Olver, C. E. Perry, W. G. Taylor, * J. F. Thurston, F. J. Walder, * S. B. Woollatt, B. E. Wooster, E. B. Wood.

FINAL EXAMINATION (Three Years Course).

Messrs H. Barnard, London; L. Barnard, London; W. R. Clarke, Rich-

[1] In this and the succeeding Pass Lists † indicates with First-Class Honours, and * with Second-Class Honours.

mond, Yorkshire; R. G. Gillard, Grantham, Lincolnshire; E. L. Stroud, London; J. P. Murphy, London; W. A. Bull, Banbury, Oxfordshire; H. Nicholls, Thrapstone; G. H. Parr, Louth, Lincolnshire; A. L. Farrant, Brighton; A. J. Moffett, London; C. E. Parker, London; H. P. Hogben, Folkestone; W. Beddard, Wolverhampton; G. Dunne, Dublin; G. Elmes, Harpenden, Herts.; T. S. Grove, London; W. G. Gillam, Brighton; A. R. Guines, Chesterfield; W. Golding; F. B. Hodgkinson, Marple, near Stockport; R. F. St. Clair Houston, Portglenone, Co. Antrim; A. O. Johnson, Ipswich; H. A. Idenden, Hastings; E. W. Parks, Bexhill; S. W. Pratt, Bath; J. Pugh, Three Crosses, S. Wales; C. Peirce, Naples, Italy; Robert Platt, Glyn W. Ruabon; B. Sumner, Liverpool; W. Denington, Shepherds Bush, W.; A. H. Berry, Streatham Hill; H. Williams, Lincoln; H. A. Lenox Conyngham, Moneymore, Ireland; R. Spooner-Hart, Calcutta; J. Stewart Wood, Walton-on-Thames; A. Doyle Bingham, Poona, India; J. A. H. Engel, Liverpool; Harry H. Worrow, Shadwell, E.; A. J. Curtis, Bideford, N. Devon; Harry Edie, Camden Road, N.W.; J. Hughes, Bethseda, near Bangor; W. James Heley, Leighton Buzzard; Stanley W. Jones, Dartford, Kent; R. C. Mathews, Newport, Mon.; J. L. Webb, Bishop's Stortford, Herts.; W. C. Prudanes, Great Berkhamsted; R. P. Thomas, Brecon; A. E. Payne, Walton-on-Thames, Surrey; P. T. Hagmaier, London; E. B. Bartlett, Quay, Dartmouth; J. S. Pike, Swansea, S. Wales; C. H. Spurgeon, New Barnet; J. H. Burnet, Vancouver City, British Columbia; W. J. Browning, Hythe, Southampton; H. B. Eve, Louth, Lincolnshire; R. Gilby, Spratton, Northampton; P. S. Howard, Ely, Cambs.; F. G. Liddle, Newport, Shropshire; A. Maynard, Romsey, Hants; C. W. Stanley, Burton-on-Trent; F. T. Trewin, Bradworthy, Holsworthy; F. A. Verney, Stratford-on-Avon; W. Wordley, London; C. E. Wells, Swaffham, Norfolk.

ROYAL (DICK) VETERINARY COLLEGE, EDINBURGH.

PASS LIST.

The following are the Pass Lists of this Institution for Session 1895-96.

FIRST PROFESSIONAL EXAMINATION.

Messrs J. Cowan, P. Donovan, W. Lawson, A. Newell, *J. J. O'Connor, E. O'Neil, R. Burt, A. Lauder, W. J. Lewis, *F. Leech, R. Bryden, *H. E. Audley Charles, *F. W. Coates, *W. P. Cushnahan, T. Fleming, *J. J. Garside, *W. G. Girvan, *A. Gofton, *T. Hogg, J. F. Joyce, *W. S. King, *W. Ludgate, *E. Little, A. M'Gregor, *J. M'Ilvena, J. A. Russell.

SECOND PROFESSIONAL EXAMINATION.

Messrs M. Allan, D. C. Barmingham, B. S. Cockerton, S. Craig, J. Dixon, C. Goundry. J. Grant, T. F. Hall, J. A. Hewson, *J. E. Holroyd, A. F. S. Jackson, P. J. M'Cloghry, F. J. Pringle, J. Robertson, A. Scott, R. C. Smith, †R. Wall, T. Wilkinson, *A. J. Williams, J. B. Kay, E. Launder, H. Leyshon, J. G. Blackwood, H. J. Bradbury, C. Farrar, A. Hodder, T. D. Lambert, *R. H. Lambert, A. M'Gown, E. C. Orton, W. J. Foley, J. L. Frood, T. Loughran, J. O. Brien, T. J. Doyle, D. Dudgeon, †E. Brown, *T. H. Brown, †A. C. Burton, G. W. Blocksome, E. Evans, *A. Gibson, J. Magiure, P. J. Maper, C. F. Parsons, *H. Percy, J. W. Pollock, *C. A. Reid, *H. Ryan, †W. Tart, T. H. Trantar, *S. A. Winhup.

THIRD PROFESSIONAL EXAMINATION (Four Years Course).

Messrs W. Cathcart, *J. Brownless, N. Howe, *J. J. Jackson, *H. Lomas, J. Stevens, *W. Nurgatroyd, J. F. Talbot, W. J. Watt.

FINAL EXAMINATION (Three Years Course).

Messrs D. Bolton, J. H. Carr, J. J. Edgar, P. M. Edgar, *F. G. Edwards, S. W. Haffield, J. C. Heather, N. Irvin, *G. Moir, A. J. Sellars, J. M. Sinclair, *J. M. Watson, F. S. Clay, J. H. Conway, A. M. M'Clew, T. K. Ramsay, E. Weynham, J. Caldwell, P. J. Harris, W. H. Nicol, D. Reid, W. T. Casewell, C. J. Clifford, R. Henderson, A. C. Smart, J. Walker, R. F. Watson, W. Aulton, R. Barker, S. E. Morton, C. Neil, H. Robson, W. Young, A. Weighton, F. Johnstone, R. C. H. Brayn, J. Willett, Thomas M'Caffery, P. Duffy.

GLASGOW VETERINARY COLLEGE.

PASS LIST.

The following are the Pass Lists of this Institution for Session 1895-96.

FIRST PROFESSIONAL EXAMINATION.

Messrs E. Souter, A. M. Spittal, J. Baird, J. P. Small, D. Frew, A. M'Dowell, A. Robb, W. Watson, G. W. Barbour, J. J. Aitken, W. Gardner, D. M'Hattie, R. Livingstone, J. A. Montgomery, T. C. R. Boleyn.

SECOND PROFESSIONAL EXAMINATION.

Messrs *H. G. Simpson, *D. Jack, J. Reynard, E. P. Jenkins, J. M'Intyre, J. Crawford, W. Crawford, W. Kilpatrick, D. Walker, A. Fraser, H. O'Neil, W. Burke, †J. J. Smith, P. M'Kinley, J. W. Conchie, R. H. Johnstone, J. C. Erskine, *H. Oliver, *C. M'Kay, J. Shannon, R. Jones, J. Stevenson, *D. Weir.

THIRD PROFESSIONAL EXAMINATION (Four Years Course).

Messrs J. Marshall, J. M'Eachran, J. Donaldson, J. R. M'Call, R. Anderson, T. Rennie.

FINAL EXAMINATION (Three Years Course).

Messrs G. Mayall, J. M. Sterling, A. S. Adams, J. Paton, D. Wyllie, J. M'Lean, J. Brown, R. M'Donnell, M. E. White, J. Watson, R. Mitchell, J. A. Todd, R. Miller, J. M'Neil, L. Macqueen.

NEW VETERINARY COLLEGE, EDINBURGH.

PASS LIST.

The following are the Pass Lists of this Institution for Session 1895-96.

FIRST PROFESSIONAL EXAMINATION.

Messrs D. M'Donald, C. R. Twist, W. F. Wilson, T. C. Howatson, A.

Scotsman, H. Whipp, E. J. Fimicane, C. H. Harrison, T. R. Weedah, S. Robson, H. Dyson, J. Evans, †W. L. Gascoigne, G. H. Livesey, A. M'Nae, †H. V. Messman, R. A. Plunkett, *H. Taylor.

SECOND PROFESSIONAL EXAMINATION.

Messrs *A. P. Beesley, †J. D. Knowles, *J. H. Lomas, A. Lawrie, M. J. Mitchell, A. J. O'Leary, *R. D. Williams, R. J. Bailey, *H. A. Ferguson, H. Briggs, H. G. Brittain, G. Barras, J. C. Blake, E. Marrison, †G. T. Roberts.

THIRD PROFESSIONAL EXAMINATION (Four Years Course).

*Mr H. Savage.

FINAL EXAMINATION (Three Years Course).

Messrs Broomhead, T. Bowlar, J. C. Deville, A. Ferens, J. E. Hardie, R. H. Knight, R. Rawhus, A. O. Hughes, J. T. Allen, J. M'Thail, J. Bibby, J. B. Cowt, T. Dickinson, J. Lyons, W. Russell, W. Rostron, R. J. Munnaise, W. L. Cockburn, J. Connell, D. J. Elias, J. Hutchison, H. S. Jones, J. Kenyon, *M. E. Williams, J. Nutall, H. Phelan.

ROYAL VETERINARY COLLEGE, LONDON.

INAUGURATION OF THE WINTER SESSION, 1896-97.

THE Winter Session at the College was opened on Thursday, 1st October, the inaugural address being delivered by Professor Macqueen. There was a very numerous audience, the large Lecture Hall of the College being filled to overflowing with students, members of the profession, and others who take an interest in the Institution.

At the opening of the proceedings the Chair was taken by Sir Nigel Kingscote, K.C.B., who said:—

"Gentlemen.—Lord Crewe, who is on his way here, has telegraphed to us that his train is late. We have given him a few minute's grace, but we thought we would not keep you waiting any longer. We hope his Lordship will be here in a very few minutes, and therefore I think the best thing I can do is to call upon Professor Macqueen to begin his introductory address" (cheers).

Professor M'Queen, who upon rising was greeted with loud cheers, then delivered the inaugural address. He said:—

"At the opening of a new session, long-established custom requires from a member of the staff some remarks of a general character touching the education and prospects of the students. To those who have just been enrolled, I have to say, on behalf of my colleagues, that we welcome your accession to the ranks, and assure you that no effort will be spared to give you every assistance in your studies. It is a pleasure to note such a large increase in your numbers. Large classes form the best testimonial a Veterinary College can receive. Besides showing that the teaching gives satisfaction, they afford the best proof that our profession is gaining in public esteem. I need not congratulate you upon your choice of a vocation, for choice implies preference, from which it follows that you prefer the veterinary to any other calling. Assuming that your choice has been well-founded, and not determined by accident, motives of self-interest, or by that fallacy,—a love for animals, let me say, that if you bring good average health and diligence to the work which lies before you, and, afterwards,

determination to do your duty, as members of a rising profession, you will have no cause to regret the day you entered upon the study of veterinary medicine. There are some very important facts which have a direct bearing upon the career of the student, and which may very properly be mentioned at once, since the sooner they are realised the better. What is to be done should be done earnestly. Time is precious, opportunities are limited, money is valuable. Therefore, you will not be justified in squandering your money, neglecting your opportunities, or wasting your time.

"In the very old days, how long, I know not, veterinary practitioners were regarded as a special race. They were said to have a peculiar alert cuteness of feature, and to wear a distinctive garb, redolent of aloes, turpentine, and tar. Addicted to original expletives, they were given, somewhat, to phonetic spelling, to chewing straws, and carrying, as a sort of symbol of industry, the never-failing ash plant. Whether or not any such creatures ever lived outside imagination, no one knows, but there can be no doubt that the race is now extinct. Veterinary surgeons to-day, are very much like other successful professional men. The comparison might be expanded to the limit recognised at heated discussions in Ireland, but modesty forbids. I may, however, add that veterinary surgeons have the usual endowment of the higher virtues, which they practise constantly. Their general knowledge is as good as that of their neighbours, and their professional attainments leave little to desire. They require, perhaps more than other men, patience, courage, nerve, and dexterity, and, to succeed in practice, they must be rich in observation, common sense, and tact of the better sort, not that counterfeit plausible deception, which may send reputation up like a rocket, but only to fall like the proverbial stick. To the question: What is a veterinary surgeon? the answer should be: One skilled by special training in the treatment of animals in health and disease. That is my conception of the position to which you aspire. What is the training? It is a long story, but I will tell you something of what it was and what it is. In my time, twenty-one years ago, the preliminary test of general knowledge was a mere appetiser, which everyone took heartily. The professional studies were served in two courses of seven months each, and there were two examinations. The subjects of chief importance were anatomy, physiology, and the principles and practice of veterinary medicine and surgery. Chemistry, botany, and materia-medica, with dissections, demonstrations, and clinical work completed the curriculum. Whilst no one could grumble at the quality of the mental food, its bulk was far from satisfying. It was a simple, plain diet, not difficult to masticate, easy to retain, and warranted to keep the gizzard of practice for an indefinite time. Looking back, although the curriculum was shorter, I think students had more leisure to exercise their senses and ruminate, or with Sydney Smith, 'to watch sparrows and project idle saliva into the passing stream.'

"Now, we are fallen on other and different times. The veterinary student's preliminary examination in general education is the same as that required from students of human medicine. The course of professional study has been extended to four years, and there are four examinations, partly in writing, partly oral, and partly practical.

"The first year at College is given to junior anatomy, chemistry—theoretical and practical, botany, and zoology. The second to senior anatomy with dissections, physiology and practical histology, stable management, and the principles of shoeing. The third to morbid anatomy, pathology and bacteriology, with demonstrations and practical work, therapeutics, materia medica, and practical pharmacy, toxicology, hygiene, and dietetics. And the fourth year is devoted to the principles and practice of veterinary medicine and surgery, meat inspection, obstetrics, shoeing, operations,

clinical work, and examination of horses for soundness. To qualify for the diploma (M.R.C.V.S.), a student at the Royal Veterinary College must give his attention to nearly 700 lectures, 200 demonstrations, and more than that number of clinical and tutorial classes. He must attend the examination of 1800 or more animals brought to the College for advice and treatment, and watch the progress of the patients in the Infirmary. He must take his share of the practice at the Free Clinique, where 5000 horses and dogs are treated every year. Lastly, he must take an active interest in the examination as to soundness, of from ten to eleven hundred horses of all classes.

"That is a bare index of the curriculum at this college. Is the instruction insufficient? Was it ever better, or even half as good? If frugality was the motto twenty years ago, surely prodigality is the watchword to-day. Yet dissatisfaction is sometimes expressed! Notwithstanding an extended curriculum, more exhaustive teaching, and the addition of supplementary subjects, to say nothing of vastly increased opportunities and greater facilities for acquiring knowledge, the complaint is made that students learn less now than formerly. 'The voice is Jacob's voice, but the hands are the hands of Esau!' I frankly admit, and believe that everyone concerned regrets, that our supply of diseased cattle, sheep, and pigs is unequal to the demand. Indeed, if anyone will suggest the means whereby a well-stocked farm can be lifted and set down successfully in Camden Town I feel sure he will not go unrewarded. But in spite of the absence of a superabundance of sick cattle, sheep, and swine, the pre-eminence of the present course of instruction can be defended against any champion of the alleged super-excellence of the past. In maintaining that our students are better taught and that they learn more than any class of past years, no reflection is made upon the sterling products of the teaching that is gone. The ever-green wisdom of the lectures by Spooner, Dick, Simonds, Gamgee, and other well-known professors, lives and flourishes in many of our best known men. But improvement was inevitable, and it must come again and again with increased knowledge, greater accuracy, and deeper learning.

"The professional examinations are not conducted by the teachers, but by independent examiners appointed by the profession's parliament—the Royal College of Veterinary Surgeons—which sits at 10 Red Lion Square. Too often the Royal Veterinary College is confounded with the Royal College of Veterinary Surgeons. The distinction has some importance, and it should be better known. The *Royal Veterinary College* was the pioneer veterinary institution of this country. It laid the foundation of our science, and gave us our name. And in simple justice we must acknowledge that the development of the veterinary profession, its progress and prosperity, are largely owing to the foresight, wisdom, liberality, and spontaneous efforts of the long line of noble and distinguished governors of the Royal Veterinary College. In 1844 the necessities of the time called into being the *Royal College of Veterinary Surgeons*, which was incorporated fourteen years before the corresponding body of the medical profession. From 1844 to 1881 the only function performed by the Royal College of Veterinary Surgeons was the examination of students. In 1881, when the Veterinary Surgeons' Act became law, the Royal College of Veterinary Surgeons took charge of the decorum of the profession, and subsequently, with more confidence in its powers, gradually raised the standard and increased the number of examinations. Quite recently the responsibility of fixing the attainments in general education of intending students was assumed by the same corporation, which now regulates and conducts the professional examinations, grants the diploma, and keeps the Register of Veterinary Surgeons.

"Touching the general education of veterinary students no one can fail to appreciate the effect upon our future of the recent improvement of the pre-

liminary examination. But the reform was not obtained without opposition. It was held that the higher standard would bar the way to many deserving men who might otherwise enter the profession with no discredit to its members. This objection contains the usual grain of truth, but it takes no note of the cheapness of education. Education never cost less than it does at present; and as every candidate for the preliminary must have lived for fifteen or sixteen years before the necessity of undergoing the test can arise, there can be no reasonable excuse for his putative ignorance. We have been told that poverty—want of money—is no crime, though, I must confess, it is very inconvenient. But poverty of education in a youth destined for a profession is only a temporary misfortune. The true student never baulks at a difficulty; given time, enthusiasm, and its complement brains, no ordinary preliminary examination will stop his progress. It is unwise to predict without knowing, but it may not be long before a degree in arts will be required as a condition precedent to the registration of medical students. Should this happen, the Royal College of Veterinary Surgeons may put its imitative faculty to work, and—what, I need not say. Meanwhile, those who may be responsible for the general education of coming veterinary students should bear in mind that the recent advance in the preliminary is probably only the beginning of further extension.

"Professional examinations when first instituted were intended to ascertain the progress made by the student in his studies and whether he had assimilated sufficient information to fit him for practice. Now they seem designed to test the agreement of one man with another as to certain symptoms, lesions, or other phenomena. If the two concerned happen to agree as to the appearance, function, or fate of something, which neither possibly has ever seen, one is made happy; but should they disagree owing perhaps to one having failed to see the thing in question, or its exact image, in the same condition as the other saw it, one is made unhappy. The happy or unhappy one is the student. Few men who have not been teachers, ever make satisfactory examiners. They improve, no doubt, with practice, but the cost in student's scalps is dear. Inexperienced examiners generally err by expecting ripe answers from raw heads. They may know that facts are stubborn things but they prefer opinion—the student's opinion—though in practice they might disregard it. They forget that questions though written may be ambiguous, and that terminology may grow out of date if not of joint. Questions of no earthly importance they sometimes put and gravely press as if the fate of Turkey depended upon the answer. Some examiners are pleased with short or index answers, but others, insisting upon the whole contents, are only satisfied with answers constructed after the redundant style of Eskgrove's judgment in a case of murder of a soldier by stabbing:—'And not only did you murder him, whereby he was bereaved of his life, but you did thrust, or push, or pierce, or project, or propel the lethal weapon through the band or belly-band of his regimental breeches, which were his Majesty's.'

"I am glad to be able to say that the examiners of veterinary students are generally very fair, if occasionally leaning to inconsistency in their awards. At our examinations, honours are given to students who gain more than 60 per cent of the marks, but somehow honours seem to diminish as knowledge grows. At the *first* examination students score well; at the *second* not so well. At the *third* they score badly, and at the *final* they seldom score at all.

"Take the July examinations of this year, in London, Edinburgh and Glasgow, and see how the honours stand!—Class A, honours, 26; Class B, 22; Class C, 8; Final (Theoretical and Practical) honours—only one.

"The fewness of honours awarded in the C and final classes, I will not

attribute to the defective knowledge of the students, nor will I admit that the teaching at all the schools merits no better results, though it has been hinted that teachers are only human—if examiners are divine. But, when I tell you that, within two or three weeks after the July examinations, two of our 'unhonoured' students gained nearly full marks and the first and second places at the Fitzwygram Prizes' Competition—a much more trying ordeal—you may wonder what could be the cause of their comparative failure before the examiners of the Royal College of Veterinary Surgeons.

"Leaving this delicate question, which demands much careful consideration, permit me to refer to some of the subjects set down in the Examination Schedule of the Royal College of Veterinary Surgeons. Although the instruction given here is necessarily based, to some extent, upon the requirements of the Schedule, teachers are bound to cover more ground than is ever gleaned by examiners. The governors of the Royal Veterinary College endeavour to provide the best education that can be got to enable students not only to pass their examinations with credit, but to practise what they profess to the public satisfaction. Whether or not the time and energies of students and teachers, as at present husbanded, completely realise expectation others must judge. But the pressing exigencies of life, with no immediate prospect of an alarming increase in its span—would seem to suggest that the direction and limitation of our studies should, from the outset, be determined by the use we are to make of them in the future. All knowledge is good and general culture excellent; but encylopedic learning has no market—even were it possible to the ordinary man. Proficiency in the art and science of veterinary medicine is what we require, and to attain this we must be content to remain more or less ignorant of many branches of knowledge. Specialisation is all important. Our specialism begins and ends with the care of animals in health and disease, and our students should be thoroughly examined with that prime object constantly in view.

"May I venture to suggest what might be done? Apply the pruning knife to the examination schedule, but do not shorten the period of study. Begin with the first examination, revise chemistry, botany, and zoology, and remember that many students now enter College fairly well acquainted with these subjects. What is the use of much of the chemistry now taught to meet the examination? Shall anyone reply as did Franklin when asked about the use of electricity—'What is the use of a new-born infant?' The answer would be good if we could discover in current chemistry the elements of future strength and usefulness in practice. Does the veterinary surgeon ever require to make sulphuric acid, alum, or pig-iron? Does he profit in the least from his endeavours to ascertain the composition of that 'small white powder?' Does he ever trust his own analysis of urine, milk, or meal? In disinfecting a cow-shed must he know how many cubic feet of gas will rise from a ton of burning sulphur? By all means give an examination on chemistry—physiological, pathological, and pharmaceutical, the chemistry of foods and of the farm—not the chemistry of chemical works, iron works, print works, and gasworks, but that which may be helpful to our other studies, and of use in later life.

"In regard to botany, I must confess to having held, a few years back, the hope of knowing something of botany—structural, functional, and systematic —from the bulrushes which hid Moses for a time to the willows by the brook, but the immensity of the task, not to speak of its seeming lack of utility, caused me to resign my efforts to become a veterinary botanist in favour of another and less arduous pursuit. What can be said for the retention of botany in the examination schedule? Should not the twenty or more poisonous plants be given wholly to toxicology? The fodder plants belong to hygiene, which takes cognisance of their feeding values. The medicinal plants form a considerable part of materia medica, and the fungi and algæ of

importance to us, belong to bacteriology. Excluding these groups many hundreds of British species will be left, besides plant structure, physiology, and classification. But, to the ordinary veterinary surgeon, what is the purport of the structure of tree trunks, the vagaries of roots, or the variations of leaves? What can it matter to him that the fruit of the apple tree is a pseudocarp, or that the placentation of the primrose is free-central. Yet, as some persons plead, botany is a splendid mental drill, and it teaches the students to observe. Let both be granted. Does not the schedule contain other subjects of even greater usefulness; subjects that furnish not only exercise in observation but information, which the student must retain? Has anatomy lost its purpose? Has physiology no secrets? Has pathology no mysteries to solve? Would not observation give better results if cultivated a little more in the dissecting-room, *post-mortem* house, the loose-box, and in watching lameness? If there is so much to learn and so little time to learn it, why trifle by the way to study flowers? Why not begin at the outset to concentrate observation upon the things that must be observed, and observed accurately if we would succeed in practice?

"During your college career you will have opportunities of gaining distinction. Certificates of merit, medals, and class prizes for industry, proficiency, and good conduct will be awarded to deserving students. There are four 'Centenary Prizes' of the value of £20 each. These will be awarded to the most efficient student in each of the four classes. It is now possible for brilliant students to win back in prizes the whole of their college fees. There is also the competition for the valuable prizes given annually by Sir Frederick Fitzwygram—a real friend—whose munificent encouragement of veterinary students must have cost him thousands of pounds.

"Having satisfied the examiners and obtained the diploma of the Royal College of Veterinary Surgeons, your licensed responsibilities will begin. You may enter the Army Veterinary Department, which offers an appointment well worth attention. The terms are good, and in no other sphere of professional usefulness will you be sure of a better pension. You may elect to devote your accomplishments to hygiene and meat inspection—a department of great and growing importance. In this work you will probably meet with medical men who still hold hazy views of the veterinary surgeon's education. You must enlighten them, and you need not fear the encounter. The instruction you will receive here on pathology, bacteriology, and meat inspection will enable you to hold your own.

"You may go to the colonies where appointments wait the coming of the right men. Canada, the Australian colonies, New Zealand, India, the South African provinces, and the United States offer, and will continue to offer, excellent reward for genuine veterinary skill. Your diploma, like a note of the Bank of England, will carry its face value wherever you may go. But you may remain at home and cast your die in town or country, where you will be sure of a competence if not a fortune. Town practitioners everywhere seem always busy. Country practioners, hale and hearty as of yore, show no sign of the rust of idleness. They still take an interest in the lands and buildings adjoining their dwellings, but whether as proprietors or intending purchasers I cannot say. You will look in vain among veterinary practitioners for that anxiety of countenance which generally comes with the struggle for existence. Few men become bowlegged through weight of wealth, and if veterinary surgeons must be claimed for the light-pursed or straight-legged variety, it is mainly owing to their adoption of a custom which may be described as vicarious possession. Genuine wealth of any kind—material, mental, or manual, is seldom ostentatious, but false poverty is often clamant. A bankrupt veterinary surgeon is a rare sight, and the Bankruptcy returns for 1895 give no promise of its greater frequency. But go where you may, in any capacity, you will find

competition, which is a good thing for good men. Do not be discouraged by the literature of prediction. In every walk of life you will meet persons who prefer the black keys of the piano—men who would buy their coal in bags could they be sure of the date of the Millenium. Already our pessimist friends have seen the signal. With a prevision worthy of Balaam's ass they see disaster to our calling in the approaching autocar. The fate of the veterinary profession has been sounded. It is to sink with depressed agriculture. Could a better companion be found? Agriculture, the backbone of England, somewhat ankylosed perhaps, but still the backbone only made stiffer by foreign competition. Think of the splendid success of the annual exhibitions of the Royal Agricultural Society, of the many County Societies of England, Scotland, and Ireland, and of the Smithfield, Dairy, and other Shows held in the Agricultural Hall. In face of the continued prosperity of these exhibitions, where is the danger to veterinary practice? Wheat has fallen in price, yet the area of wheat-growing land has considerably increased of late. Harvest thanksgiving services continue in spite of low prices and the absence, after a poor crop, of the too conscientious Scotch farmer who 'didna care aboot approachin' his Maker in a speerit o' sarcasm.' The suppression of pleuro-pneumonia and other contagious maladies in home stock, and the restrictions upon importation of cattle from infected countries, have imparted confidence to the former. More attention is now given to breeding all classes of farm animals, and veterinary surgeons will have little to fear from the fall in wheat while cattle, sheep, and horses maintain their present values.

"But I would not have you believe that success will come without effort. You must not imitate Quashie who lay under the flapdoodle tree waiting idly for the flapdoodle fruit to ripen and fall into his mouth. You must work. Disease, accident, and sudden death will have to be investigated and satisfactorily explained. Many of your patients will tax all your skill. Never pronounce a case hopeless until you are sure that it *is* hopeless. Don't anticipate death, wait till it comes. Don't give in at the first attempt to diagnose an obscure case. Go over the ground again, persevere, and keep your own counsel. The man who once masters the art of keeping his mouth shut when he has nothing to say will always command respect. Remember that one success will not serve a lifetime. Clients are inconstant, and practice varies. Sooner or later, in transactions—horse and other—you will meet with men whose word is as good as their bond. Prefer the bond, it is safer. You will have various clients, good, bad, and extraordinary; some easy and affable, others awkward and difficult, and a few obstinate. Here tact should serve you well. You will be asked questions which no man may answer, as—Why should my horse fall lame? Do not dissimulate; out with the truth, it lasts longest. Try to combine judgment with your technical knowledge. Do not dissuade a client from buying *every* unsound horse; nor too confidently recommend every sound one. Either may be useful, or both may be worthless. You will have temptations many and various, 'But where you feel your honour grip, let that aye be your border.' Keep up with the times. Buy the latest books, and don't forget the weekly, monthly, and quarterly journals. Read through and round your science. Do not cling to old ideas that have been exploded, or to methods that have been superseded. But do not reject the old merely because it is old; retain the useful and the true. Know what has been done and what is doing in the profession; take an interest in its meetings, and its government, and do not grumble at reforms after they have passed. If promoted to the Council of the Royal College of Veterinary Surgeons, take the Epistle of James as a rule of conduct, and think long and earnestly of the needs of your comrades before you attempt to legislate for them. Raise the popular taste if you can, but do not give way to low opinion. Try to fulfil your own ideal in a profession for which

there is a great future Be assured that veterinary science has not yet reached its pinnacle; the public have not yet measured its usefulness or its power of doing good, and everyone of you may help its upward progress. The faithful, assiduous, and efficient practitioner will surely find his reward; if not in riches or material prosperity, it will come in the acquisition of learning, the consciousness of good work well performed, and in the final approbation and 'well done' of the Great Master. Know your duty, do it manfully, and keep your reputation 'unspotted from the world.'"

LORD CREWE, who had entered the meeting and taken the Chair during the course of Professor Macqueen's address, said:—

"Gentlemen.—In rising to ask you to accord a vote of thanks to Professor Macqueen for his address, it is only becoming first of all that I should apologise to you for my late arrival, due in part to the peculiarities of the railway service, and in part also to the existing dispute between the railway companies and the cab-drivers—a dispute as to the merits of which wild horses would not drag from me an expression of opinion (laughter).

"I regret on my own account that I should have missed any part of the most interesting and instructive address to which we have just listened, combining as it did the most serious and sound advice with a wealth of humorous comment which I could not but greatly admire. Well, gentlemen, I hold myself fortunate in having been called upon to take the Chair to-day, at the close of a year which has been a successful one for this College, and about which I fancy there is nothing to be said that is not pleasant. It has been, as I understand, an interesting year, as the first during which the results of two changes, to which Professor Macqueen alluded, began to be appreciated. I mean that of the raising of the standard of your preliminary examination, and the increase in the term of studentship by one year. As Professor Macqueen has said, considerable fears were entertained at the time those changes were made that the result might be that good men would be prevented from coming forward, and that the supply of veterinary surgeons would begin to run rather short. Well, it is very gratifying to find that these fears have proved to be altogether unfounded (cheers.) And it is, of course, an obvious thing that the extra period of study here, which I for one fervently trust may be maintained, must be of great advantage, as giving a longer time to the students to engage in the vast amount of practical observation which can be found here, and which they can never find again to the same extent at any other period of their lives.

"Now, Professor Macqueen alluded towards the close of his speech to what I believe to be a distinct fact, viz., the public misapprehension which certainly exists in some quarters as to the amount of study and the amount of science which are required by those who undertake the profession of veterinary medicine. It is, I believe supposed by a good many people that much less science is required in your profession than in that which is generally known as the medical profession. Well, gentlemen, we know better. We know that all the early years of study of a veterinary surgeon are not on parallel lines with those of a medical man, but are absolutely upon identical lines, and it is only later on, when it comes to the actual practice of the profession, that these lines begin in some degree to diverge. It is somewhat unfortunate that in the practice of your profession you are often not permitted to deal with the most interesting cases such as a medical man may deal with. Long, complicated, difficult, and chronic cases are very often not left to you to deal with, except in the case of valuable thoroughbred horses, valuable pedigree cattle, and the pets of fond and wealthy old ladies (laughter), for in such cases it is very often found that a dose of poison or a charge of shot is after all the simplest way of closing the disease and the life of the poor patient. At present at any rate prejudice prevents the application of such

strong remedies to the incurables of the human race. In this way, therefore you are deprived of these interesting and complicated cases which are the principal delight of the scientific mind. The result of that state of things is somewhat singular. You probably have, owing to the greater number of *post-mortems* which you make, and to the fact that animals are often killed at the height of a disease, considerably greater opportunities of acquiring skill for dealing with these very complicated and difficult cases, and yet you are not allowed to deal with them.

"Now, gentlemen, Professor Macqueen said towards the close of his address something of the relationship of your profession to agriculture, and, as belonging to the distressed class of agriculturists, I listened with very great interest to what he said on that subject. You have performed in your profession, and you may still perform in your profession, a great work in dealing with those epidemics which ravage our live stock. Sir Joseph Lister, in his most interesting address at Liverpool the other day, spoke with approval of the use of tuberculin, which, although it has not carried out what was expected of it in the human race, has proved of great value in the diagnosis of tuberculosis in cattle. And we must also not forget the use of mallein, which has proved of such value in the diagnosis of that most terrible of all diseases—glanders, which we hope may in due time be stamped out altogether (cheers).

"But there are one or two other matters in connection with agriculture in which you still, I think, have a great deal of work before you in helping distressed agriculturists. The first of these that occurs to me is abortion. We are always being told the one hope for the British farmer is to improve the quality of his stock, and it stands to reason that as the quality goes on improving so the loss—the great loss—which the farmers suffer through cases of abortion becomes more and more severe as the value of each individual animal increases, and I should be sincerely glad to think that the attention of your profession is being closely directed to the prevention of that most vexatious disease to the farmer.

"And the other point which occurs to me in a special degree has reference to swine-fever. When I was in Ireland we adopted there the procedure which had previously been adopted by the Board of Agriculture in England, and I remember very well that in Dublin Castle there hung a map which was stuck over with flags at the points at which swine-fever had taken place. I am sorry to say that in many parts of Ireland there was more flag than map, and the amount which had to be paid in compensation reached a most alarming figure. So far as I know, speaking as something of an ignoramus on the subject, very little has been done as yet to cope with this most vexatious disease. Farmers large and small in England depend, and I think will have to depend, a good deal on pigs for the function which that animal has so long fulfilled in Ireland—that of paying the rent (laughter). I remember being told of a village wife who at brief intervals of time lost a pig and also a near relative. I place them in this order for reasons which you will apprehend in a moment. Her neighbours observed with some regret that she seemed to feel the loss of the pig a good deal more than the loss of the relative, until she at length gave her reasons for so doing, which were that she obtained some consolation from the loss of her relative from the feeling that the relative had gone to a better world, while the pig from every point of view was 'nothing but a dead loss' (laughter). That evidently was before the days of compensation. But if the united genius of the veterinary profession could find some means of preventing the spread of this disease, you would earn the gratitude of a great many humble homes both in England and Ireland.

"Well, gentlemen, it only remains for me to congratulate those of you who are going to belong to a profession which I think is both an interesting and

an honourable one. As Professor Macqueen said, the prizes of it are not of a dazzling character, but he pointed out, as I think, with great force and wit, what the substantial advantages of it are. It is an interesting profession, I think, because most men—most Englishmen, at anyrate—find particular interest and pleasure in dealing with animals and in endeavouring to understand their different characters and their different habits. And it is also a noble profession because it deals with the alleviation and diminution of pain.

"I wish, finally, to congratulate those who have been fortunate enough to win prizes and distinctions during the past year. I sincerely hope that with them, as with all students here, the distinctions they have gained will be the beginning of a long, successful, and happy career (cheers). In conclusion I have to move that the best thanks of this meeting be given to Professor Macqueen for his address" (applause).

THE CHAIRMAN, rising again, said: "I will now call upon the Principal to read out the prize list" (cheers).

PROFESSOR M'FADYEAN, the Principal of the College, thereupon read out the list of prize winners for the previous session (which appears elsewhere).

Proceeding, the Principal said:—"That, my Lord, is the complete list of the strictly college prizes. But there is another competition which I think I may describe as an inter-collegiate one, viz., that for the three Fitzwygram prizes to which Professor Macqueen referred. In that competition only two students are allowed to compete from each school, and I am proud to say that on the occasion of the most recent competition, viz., in August last, the two gentlemen who were selected to represent this Institution brought back the first and second prizes (loud cheers). Those two gentlemen were Mr Verney, who obtained the first prize of £50, and Mr Browning, who obtained the second prize of £30 (applause). Curiously enough none of the other candidates obtained sufficient marks to carry off the third prize, and it is a special matter of regret to us that we were not allowed to send more than two candidates, because we felt that we had at least half-a-dozen more students good enough to take the third prize" (laughter and applause).

Sir NIGEL KINGSCOTE, who was warmly greeted, said:—"Gentlemen, I am sure none of us would wish to leave this lecture hall to-day without returning our most hearty thanks to Lord Crewe for coming here and presiding over our gathering (cheers). I am well aware myself that Lord Crewe has come at very great inconvenience to himself, and I know that if he had been considering only his own pleasure he could soon have spent the day on Newmarket Heath (a laugh). But I think one and all of us may think ourselves fortunate when we see a man like Lord Crewe taking an interest in all that concerns our Institution (cheers). I may say that Lord Crewe is not a mere figure head, for he is a practical man. He spent a year at the Royal Agricultural College, and he there took a peculiar interest in the veterinary department of the college. What Professor Macqueen and Lord Crewe have said to-day I entirely endorse. I hope that the veterinary profession in this country is now taking the place it ought to take. I am afraid there was a time when it was not thought much of. It is thought a great deal more of now, and I trust it always will be. There is just one thing more I should like to say. Somehow or other, although the agricultural interests is at such a low ebb there are still some signs of prosperity in the country. I see in the papers that £5000 has been given for a yearling colt. That shows that there is still enterprise in that direction. You, gentlemen, might be called in to give your opinion in such a case as that, in the event of anything being amiss with the yearling, and I can only say that I do not envy the feelings of the man who has to take the responsibility of deciding in such a case. I think that as long as we have animals of that value the veterinary profession will hold its own and flourish (cheers). Gentlemen, I must apologise for having

gone a little outside the limits of the duty I rose to discharge, which is to move a vote of thanks to Lord Crewe for coming here to-day" (applause).

The vote was carried with acclamation.

LORD CREW, who was again cordially cheered, in acknowledging the compliment, said: "Gentlemen, it only remains for me to thank you in a very few words for the kind way in which you have received the far too kind things which Sir Nigel Kingscote was good enough to say to you of myself. I can assure you that nothing elsewhere would have induced me to break the engagement to come here to-day, which I entered into a long time ago, and for which I have been fully rewarded by the kind reception you have given me on this occasion. Sir Nigel told you that I went through a short course of veterinary studies a few years ago at the Royal Agricultural College. I hasten to reassure everybody here, by stating that I am not now prepared to give any advice on that subject, either gratuitously or otherwise (laughter). I content myself by doing what Professor Macqueen advised us all to do, viz., to say nothing when we have not a very valuable opinion to offer. Consequently I confine myself to a dispassionate criticism of the treatment adopted by veterinary surgeons, when my own horses fall lame, I am sorry to say that they frequently seem to be lame. But speaking for myself, it has been a great pleasure to me as an amateur to have acquired even a little knowledge on the subject during the short time I spent at Cirencester. I thank you very heartily, gentlemen, for your kindness" (applause).

The proceedings then came to an end, and the general company adjourned to one of the class-rooms in which refreshments were served.

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TUBERCULOSIS OF CATTLE FROM THE FARMER'S POINT OF VIEW.[1]

By J. M'FADYEAN, Royal Veterinary College, London.

THE disease for which tuberculosis is now the almost exclusive name, even among laymen, was so designated because the structural alterations which are the naked eye evidence of its existence in the body of an animal generally take the form of small well-defined nodules or tubercles. The growth of these tubercles in various parts of the body was at one time regarded as the essence of the disease, and it was supposed that they were liable to form spontaneously, or at least without apparent cause, in the bodies of particular individuals, who had inherited a peculiar weakness in this direction from their parent or parents. That was the old view of the nature of tuberculosis, and, although I say old, it was in fact the generally accepted view as recently as twenty years ago. The modern view of the disease is that it is a purely contagious disease, and that the essence of it is not the formation of these nodules or tubercles, but the invasion of the body by a parasite, whose presence irritates the surrounding tissues, and thus determines the formation of the tubercles. I do not know whether there are still to be found agriculturists who hold the old view, and even if I did know that some holding that view were present here, I should consider it out of place to state at length the evidence on which pathologists have been led to enrol tuberculosis among the parasitic diseases. The man who at the present day still takes the old view of the subject is as

[1] A paper read before the Newcastle Farmers' Club, 21st November 1896.

irrational as the occasionally encountered monomaniac who maintains that the earth is flat, and that the sun moves round it.

The parasite which is the cause of all the mischief in tuberculosis belongs to the class of microscopic vegetable things called bacteria or germs. It is named the tubercle bacillus because it is rod-shaped, and its discovery by Koch was what the Germans call an epoch-making event, fraught with the most far reaching consequences in the domain of human and veterinary medicine.

The tubercle bacillus is far too small to be seen with the naked eye, but modern microscopes bring it well within our vision, and enable us to study its form and structure. We can also cultivate it outside the body in our laboratories, and by that means we have acquired valuable information regarding its mode of growth and the chemical properties of itself and its products. In this way we have learned that its growth is very slow even under the most favourable circumstances of temperature, and that unless it is kept at a temperature of about 90° F. no growth takes place at all. From these facts we may draw a very important conclusion, viz., that the germ when it is voided from the body of a diseased animal will seldom or never find in the outer world the conditions essential for its growth and multiplication. It may in favourable circumstances retain its vitality like a seed outside the body, but it will not multiply there. Another way of stating that is to say that whenever an animal contracts tuberculosis the germ that infected it was bred in the body of a previously tuberculous man or animal. In this respect tuberculosis is like glanders and other purely contagious diseases, or, to take an illustration that may be more readily seized by some, it is like sheep-scab, save of course that the one is caused by a vegetable parasite which lives in the interior of the body, while the other is caused by an animal parasite which lives on or in the skin.

A sheep that is the subject of scab is certain to infect other sheep placed in contact with it, and the act of infection is the direct transference of the itch parasites from the diseased to the healthy animals. In like manner, when a tuberculous animal is kept in close contact with other animals it is almost certain to infect these, owing to the tubercle germs being transferred from the one to the other. In this case, as in the other, the germs may be directly transferred from the diseased to the healthy animal, as, for example, when the calf receives them in the milk from its mother. In most cases, however, the transference of tubercle bacilli takes place indirectly, the germs being voided on to the floor, or walls, or food materials, and then after a variable interval taken into the body of another animal.

But while sheep-scab and tuberculosis are thus comparable as regards the mode of infection, there are some very notable but at the same time easily explained differences. When a sheep affected with scab is introduced into a flock the spread of the disease is certain and comparatively rapid, for reasons that are obvious, but when a tuberculous animal is introduced into a herd the disease in certain circumstances may not spread at all, and even under the most favourable circumstances its apparent spread will be slow as compared with that of sheep-scab. The explanation of that is found in the following considerations. In the first place the growth and multiplication of the tubercle bacillus, even when it finds its way into the body of an

ox or cow, are slow, and it always takes weeks, and generally many months, to set up disease sufficient to seriously interfere with the animal's health—in other words, to set up symptoms. In the second place, while every tuberculous animal harbours tubercle bacilli in its body it is not constantly voiding these into the outer world. The great majority of the germs are imprisoned inside the tubercles or lesions, and in many individuals they remain so imprisoned during the whole of the animal's life.

Unfortunately, however, tuberculous disease in some situations is associated with the outward passage of tubercle bacilli. That is nearly always the case when the lungs, or bowels, or udder is diseased. When an animal has tuberculosis of the lungs or any part of the air-passages, germs from the diseased part are almost certain to be discharged through the mouth or nose when it coughs, and if they are projected on to food materials another animal consuming these is almost certain to be infected. That, however, is not the common method of infection, at least in cattle. The liquid particles containing the tubercle bacilli, when they settle on floor, walls, woodwork, or any solid object, soon become dried up, and at any moment afterwards the dried material may be detached and rise into the atmosphere as a dust particle, and be inhaled by another animal. Beyond any doubt, this is the principal way in which the disease is spread among cattle.

It was said a minute ago that when a tuberculous animal is introduced into a herd the disease in certain circumstances may not spread at all. It would not spread if the only spot of disease present in the tuberculous animal were in some deep-lying lymphatic gland, and even although the lungs were the seat of the disease, and tubercle germs were being expelled from them, the disease might not spread if the diseased animal and its fellows were kept at grass. The risk would always be present, but two circumstances would combine to minimise it; the first is that the greater the space in which the animals are kept the less certainty there is that the germs voided by the diseased animal will ever find their way into the body of another, and the second is that tubercle bacilli, while they may retain their vitality for a long time in the dark, soon perish when exposed to sunlight.

All these considerations make it plain why the greatest proportion of tuberculous animals is found among our most pampered highly domesticated breeds, among cattle stalled all the year round, and among those kept in crowded, badly ventilated premises, and they also explain the comparative exemption of cattle reared and kept out of doors.

It is right, however, to say that there is another factor besides those just mentioned which may affect the proportion of tuberculous animals found in a particular herd, viz., the breed of the animal. Given animals of the same breed or strain, the disease is certain to be most prevalent among those that are placed in circumstances specially favourable for infection; but, given a number of animals of different breeds, in identical circumstances, would they be attacked in the same proportion? For example, if into a herd composed of equal numbers of shorthorns and Galloways, one were to introduce a tuberculous animal by way of experiment, would the disease spread

equally in the two breeds? Probably many people would unhesitatingly answer this question in the negative, but, for my own part, never having had the opportunity to observe how the disease spreads in such a mixed herd, I should prefer to leave the matter doubtful. Probably the susceptibility to tuberculosis does vary from breed to breed, but at least in this country the circumstances seldom or never furnish a fair test. Tuberculosis is much more prevalent among shorthorns, Jerseys, and Ayrshires, than among West Highlanders, Galloways, or Herefords, but my own opinion is that this is mainly, if not entirely, ascribable to the different circumstances in which those breeds are usually kept.

Some people attach great importance to the supposed predisposition of different breeds and families, and many think that a special predisposition is with great certainty brought into existence by in-and-in breeding. There is, however, very little convincing evidence in favour of that opinion, and it is certain that when the circumstances favourable for the spread of the infection are present (such as overcrowding, bad ventilation, etc.), the disease when once introduced will spread, no matter what is the way in which the animals have been bred.

It is just as certain that, no matter what the breed, the disease will never start in a herd without the introduction of the bacilli.

A question that has been much debated is whether tuberculosis is frequently inherited, that is to say, whether in any considerable proportion of cases calves are actually tuberculous before they come into the world. A few years ago the orthodox opinion was that a very large proportion of calves were born tuberculous—that this indeed was the chief way in which the disease was spread. An impartial review of the evidence on the point has compelled many of us to abandon that view. And, be it observed, the point is not whether the disease is ever transmitted in this way, but whether it is at all commonly so transmitted. How is the matter to be settled? Clearly by examining the bodies of new-born calves of which one or other parent is known to be tuberculous. Well, the evidence obtained in that way appears to me to be quite conclusive, for it has shown that tuberculosis of new-born calves is one of the rarest of bacteriological curiosities. Even in places where from 20 to 30 per cent. of the breeding animals are tuberculous, the proportion of tuberculous calves under a month old is found to be as low as 1 in 10,000. Of course, in such an examination it is assumed that when all the organs are apparently free from tubercles the calf is not tuberculous, but those who cling tenaciously to the view that tuberculosis is frequently inherited deny that this is a true test, and maintain that the germs of the disease are there, but in a dormant condition. That, however, is a perfectly gratuitous assumption, and there is not a particle of evidence to justify the statement that tubercle bacilli may exist for months in a calf without leading to the production of tubercles visible to the naked eye.

The incontrovertible facts are that tuberculosis (that is to say, the tangible evidence of the presence of tubercle bacilli) is exceedingly rare in new-born calves, and it is even comparatively rare in yearlings, while it is less rare in two-year-olds, and commonest of all in adult cattle. All except those who having once formed an opinion are unable to abandon it, although it is upset by later evidence, must

admit that the hereditary transmission of tuberculosis plays such an insignificant rôle in the spread of the disease that it may practically be left out of account in devising preventative measures.

In any discussion regarding bovine tuberculosis and the best methods of dealing with it, the identity of that disease with consumption of the human subject is a fact that has to be kept in mind. One almost immediate effect of the discovery of Koch's bacillus was the general recognition of this identity, and of the necessity of safeguarding the public health from the danger which it involved. Indeed, in the minds of many people the knowledge that a disease identical with human phthisis was rampant among cattle excited a degree of apprehension bordering on panic, and there were members of the medical and veterinary profession who jumped to the conclusion that the discovery of the identity of the disease in the two species had laid bare one of the main sources of infection of human beings. In saying this I do not mean to imply that no apprehension on that head had existed prior to Koch's discovery, but at least in this country the possibility of such a danger had not up to that time attracted much attention among either veterinary surgeons or medical men, and, as for the lay public, it was quite unconscious of any danger.

The researches of Bang into tuberculosis of the cow's udder first called attention to the danger connected with milk. He showed that tuberculosis of the udder is not very rare, that the milk furnished by the diseased quarter always contains the bacilli, and that the bacilli may be present while the milk still retains its normal appearance. All subsequent researches have confirmed Bang's observations and emphasised this danger, but some have gone much further, and maintained that whenever a cow is tuberculous in any part of the body—the lungs or the liver, for example—the milk is dangerous, since it may, and frequently does, contain tubercle bacilli, although there is no actual disease of the udder itself. The more restricted conclusion was bad enough, but the wider one was in the highest degree alarming, for while one may have to examine a great many cows in order to find one with tuberculosis of the udder, it is the exception to find a dairy of cows absolutely free from the disease. Fortunately, however, in the light of repeated experiments by the most trustworthy authorities, we are justified in believing that the milk is not dangerous unless the udder itself is the seat of disease.

The history of the meat question is somewhat similar. Long before the discovery of the tubercle bacillus it had been proved by experiment that actual tubercles taken from any part of the body were capable of transmitting the disease to animals, and when the human and bovine diseases were proved to be identical there remained no escape from the conclusion that human beings could be infected in the same way, assuming that the tuberculous materials were consumed in the raw or imperfectly cooked condition. But after that point had been settled there arose a great dispute as to whether any part of a tuberculous carcase was really safe as an article of human diet. This, again, was a point that only experiment could settle, and, notwithstanding numerous experiments, it can hardly be said that opinion is yet unanimous regarding it. It would be out of place here, and would occupy too much time, to review the whole of the evidence on the point; but I think I am justified in saying that the contention that

the bacilli are generally, or even commonly, distributed throughout the whole body in tuberculosis of cattle, is no longer tenable. The visibly diseased parts are always dangerous, and in rare cases the germs may be present in the edible portions of a carcase that shows no visible tubercles, but in the vast majority of cases of tuberculosis encountered in our slaughter houses, the carcase, that is, the fat, bones, muscles, and blood, do not contain the germs of the disease, and are therefore quite safe for human consumption. A meat inspector who at the present day condemned an entire carcase on the ground that he had found a few tubercles in the lungs or liver would have great difficulty in justifying his action. That is fortunate, for had it been necessary in the interests of public health to absolutely confiscate the carcase of every animal found to be tuberculous, no matter how small the apparent extent of the disease, the difficulty of dealing with the disease would have been immensely increased.

And now I come to what is certainly the most important question of all—viz., what means ought to be taken to check or eradicate the disease? The interest of this question for agriculturists is obvious, apart altogether from the fact that bovine tuberculosis and human phthisis are identical diseases. It is a pressing question for them, inasmuch as it is beyond any doubt a wide spread disease, and one which if left unopposed is capable of inflicting serious financial loss. For the public at large it has a double interest. It is of interest to them in so far as it cuts off annually a large number of cattle—how many it would be impossible to say—and thus must tend to add to the price of beef. Undoubtedly, however, the interest which the public take in the disease arises mainly from the fact that it is communicable to human beings. I propose to look at the matter from the latter standpoint first, and to consider what is the degree of danger to which the public are at present exposed through the sale of tuberculous milk or meat, and what measures might be taken to protect human beings from this danger.

And to take the milk danger first. As previously stated, there are good grounds for believing that the milk is dangerous only when the udder is itself tuberculous, and it is only in a small percentage of cases that this organ becomes affected. When once the disease is fairly established in the udder the milk can with great certainty be used to infect experimental animals, and no doubt if man were made the subject of experiment the result would be the same. Tuberculosis of the udder is a condition that is easily detectable on veterinary examination, and indeed the disease soon forces itself on the attention of the milker, for it leads to marked hardening of the gland, and steady enlargement of it. Unfortunately, it differs from most other cases of mammary inflammation, or "weed," in that it is some time before it alters the appearance of the milk, which may therefore be sold without much fear of its dangerous quality being detected. But, fortunately, the tuberculous inflammation of the udder has special characters now well known to veterinary surgeons, and its diagnosis, when the full history of the case is known, is comparatively easy. All this suggests that a periodic inspection of milch cows by competent veterinary surgeons would go a long way to protect the public from this danger. In saying that, however, much would depend on the frequency of the inspection. Longer intervals than a fortnight would

certainly be of little use, and the compulsory inspection of all the dairy cows in the country twice a month would probably cost half a million of money annually, if not more. Besides, it must be admitted that such an inspection, although it would greatly reduce the danger, would not entirely remove it, for an udder that appears healthy to-day may become the seat of tuberculosis and secrete infectious milk in less than a fortnight. I confess that there does not at present seem much probability that a system of obligatory inspection of all milch cows in the country will soon be introduced. Stock-owners can hardly be expected to urge the Government to enforce the inspection of their cows, but if the Chancellor of the Exchequer can find the money they can hardly object, for even the most callous individual cannot claim the right to sell a deadly poison under the guise of an article of diet. A less expensive, but unfortunately also less efficient, safeguard would be to make the notification of disease of the udder in any form compulsory, and the sale of milk from a diseased udder illegal, under a heavy penalty. If this were coupled with inspection, even at considerable but irregular intervals, the present danger would be much lessened.

It must be confessed, however, that neither of these methods would give the public a guarantee of absolute freedom from the risk of contracting tuberculosis through milk, but every person can purchase that guarantee without Government assistance by simply boiling or steaming the milk before use. One may go further, and assert that that is the only way in which such a guarantee is obtainable.

And next with regard to the meat question. The danger here is much less than in the case of milk. It has been gravely asserted that human phthisis "frequently comes from the butcher's stall," but the expectation that the prevalence of human phthisis would be materially reduced by the stamping out of bovine tuberculosis is, I believe, not entertained at the present day by any human pathologist of repute. There can be little doubt that almost every one of us many times in the year consumes beef that came from an animal that was tuberculous in some degree; but that fact has no terrors for me, because the edible portion of the carcase or the actual meat-substance contains the germs only in very extreme cases of the disease, and because thorough cooking may be relied upon to destroy the germs even if they are there. On the other hand, none of us would like to have tubercle bacilli sold to us with our meat, and that is what happens whenever we buy meat that is the seat of actual tubercles. It is true that even that would be robbed of its danger by thorough cooking, but we are not on that account going to concede to the butcher the right to an unrestricted traffic in tuberculous flesh. There is only one way in which this danger can be met, and that is by the abolition of private slaughter houses, and the institution of a general system of meat inspection by skilled officers. Such a system is urgently wanted for the protection of the public against other diseases besides tuberculosis, and it is bound to come before long, whether tuberculosis of cattle be stamped out or not.

Lastly, I come to the consideration of tuberculosis from the standpoint of the farmer and stock-owner, that is, regarding it simply as a contagious disease of cattle. By that I do not for a moment mean to mply that stock-owners are so callous as to attach no importance to

the fact that tuberculosis of cattle is a possible source of danger to human beings. Indeed, they are not likely to forget that while the carcases of their animals are being confiscated to protect the health of the public. But just as pleuro-pneumonia and swine-fever are of interest to the farmer, although neither of these diseases has any bearing on human health, so tuberculosis is to the farmer a burning question from the fact that it is a contagious disease which is at the present time killing large numbers of cattle, and seriously deteriorating the value of many more.

To some it may seem an obvious point that if it is a contagious disease it ought to be brought under the operation of the Diseases of Animals Act. But before we subscribe to that conclusion there are one or two things to be taken into consideration. To ask for the scheduling of tuberculosis as a contagious disease is a sort of meaningless request, unless we have made up our minds as to the purposes for which it is to be so scheduled. Is it to be scheduled for simple notification, or are we going to ask to have applied to it the measures enforced against cattle plague, foot-and-mouth disease, glanders, or pleuro-pneumonia? The measures directed against these had for their object the complete eradication of the disease, and to that end notification, slaughter, and isolation were compulsory. These diseases have been stamped out, and there need be no doubt that bovine tuberculosis can be stamped out also, though as long as the same disease exists in the human species there would be a serious risk of fresh infection from that source.

In the case of cattle plague and pleuro-pneumonia, the disease was got rid of by the remorseless slaughter of every diseased animal and of every animal known to have been exposed to the infection. Nothing else would have sufficed in the case of these diseases, because when an outbreak occurred there was no means of picking out the healthy from those which had already caught the infection. A few years ago the same could have been said of tuberculosis, and as long as that was the case the stamping out of the disease seemed impossible on the score of cost. But the discovery of the marvellous diagnostic property of tuberculin gave the question quite a new aspect, for it put in our hands a means by which we could with great certainty separate the healthy from the already infected in any given outbreak.

Several methods of taking advantage of this discovery have been proposed. The most radical one was that planned and for a short period put into operation in the State of Massachusetts two years ago. Under an order issued by the State Board of Cattle Commissioners, every bovine animal in the State was to be tested with tuberculin, every animal that reacted was to be slaughtered, and a strict quarantine, combined with the tuberculin test, was to be imposed on all imported cattle. Apparently even in that small State, in which tuberculosis is nothing like so prevalent as it is here, the plan proved unworkable, and it was soon abandoned. In the case of Great Britain such a method of attacking the disease is altogether out of the question, as several millions of money would be required to meet the claims for compensation.

A less drastic plan of dealing with the disease is that which was embodied in a Bill brought before the French Legislature last year.

The main provisions of this Bill were: (1) Compulsory notification; (2) slaughter of every obviously tuberculous animal; (3) compulsory testing of every animal presenting suspicious symptoms, followed by the immediate slaughter of the animal in the event of its reacting; (4) the obligatory use of the same test in the case of every animal known to have been in cohabitation with a tuberculous animal, and the compulsory slaughter within one year (save in exceptional circumstances) of every such animal that reacts; (5) partial compensation for carcases seized under the Act. It was estimated that the compensation required under this method during the first year would be about £50,000, but that very moderate estimate was arrived at by supposing that only 1 per cent. of the French cattle are tuberculous. In this country the proportion of tuberculous cattle can hardly be reckoned at less than 5 per cent., and the cost during the first year would probably be about £200,000. One of the objects of this French plan was to allow the owner time to prepare his tuberculous animals for the butcher, but it is important to notice that in France the sale of tuberculous carcases is sanctioned by law except in advanced stages of the disease, and that there only a small proportion of the tuberculous animals slaughtered would have to be condemned as unfit for food.

Should the Royal Commission on tuberculosis, which is now sitting, recommend the introduction of a law here to sanction the sale of the flesh of tuberculous animals in all slight and moderate cases of the disease, and if the Government are prepared to find the £200,000 required to compensate for the carcases seized during the first year, and a somewhat smaller sum for several successive years, this plan is quite practicable for Great Britain. It could hardly be expected to eradicate the disease in one, two, or three years, but it would certainly soon suffice to make it rather rare among cattle.

But, perhaps, what would be generally favoured by those who wish the disease scheduled would be something less drastic than even this French plan, which, by the way, has, I believe, not yet become law in France. Perhaps what is desired is merely notification, with compulsory slaughter of tuberculous animals that are likely to die, or are already showing pronounced symptoms of the disease, with, of course, compensation, but without conceding to the authorities the right to test the animals in contact, or insist upon their isolation. I am sorry for those who desire that plan, for they are not likely ever to have the desire gratified. The only criticism that need be passed upon such a proposal is that, so far from its being a method likely to stamp out the disease, it would be a method of perpetuating it. The owner who at present has the disease amongst his cattle has an incentive to try to get rid of it; but if he could always rely upon getting compensation for animals in which the disease threatens to prove fatal, the main incentive to stamp out the disease would be removed.

The futility of merely slaughtering the animals that are already ill has been well exemplified in the case of glanders. For many years horses that are visibly glandered have had to be killed, but glanders is not yet stamped out. I know it has been said that the main cause of this failure is the withholding of reasonable compensation, but that I deny. The main cause is that in nearly every outbreak of glanders, after we have killed the visibly diseased, there remain in the stud

apparently healthy horses that are in reality glandered, and these serve to perpetuate the disease in their own stable, or carry it to fresh ones when they are sold.

The same method would yield similar results if applied to tuberculosis; you may kill the visibly diseased, but if you stop at that you will never stamp out tuberculosis.

The last point with which I propose to deal is this. I know nothing of the intentions of the Board of Agriculture with reference to the scheduling of tuberculosis, but we all know that at present their hands are pretty full with swine-fever, and it is not improbable that they will wish to get their foot on the neck of that disease before they tackle another. Meanwhile, the man who has tuberculosis in his stock, and who has been losing money by it, will naturally ask, Is nothing to be done? The answer to that is that he can do much for himself. If he continues to lose animals for years running he has himself to blame in a large measure. Any veterinary surgeon who is up to the times can by the aid of tuberculin tell him within twenty-four hours which of his cattle are affected. If any of these affected animals are already really ill, or otherwise present symptoms indicating that the disease is in an advanced stage, the best thing to do will be to poleaxe them and bury them. But it is seldom that this will make a very serious drain on the pocket. Most of the animals that react to tuberculin will appear healthy; these must be separated from the rest and prepared for the butcher as quickly as possible. The most convenient time to tackle the disease is spring, for many of the animals that react can then be fattened out-of-doors.

Needless to say the premises must be disinfected, and if the ventilation is defective that ought to be remedied. Having once got his stock free, he must try to keep it free, by taking care not to introduce into it any animals that will not come out with a clean bill of health under the tuberculin test.

NOTES ON PHYSIOLOGICAL TEMPERATURES.

By FREDERICK HOBDAY, M.R.C.V.S., Royal Veterinary College, London.

THE subject of the temperature of the domestic animals in health is of undeniable importance, especially just at the present time, on account of the attention paid to it by veterinarians in the diagnosis of certain diseases, and in the uses of such substances as tuberculin and mallein. The causes which affect the temperature in health ought to be familiar to everyone who habitually uses the clinical thermometer; faulty knowledge in this respect is apt to lead to errors of diagnosis, and probably also of treatment; to the veterinary practitioner this knowledge is especially important on account of the variations of normal temperature occurring in the respective classes of animals with which he has to deal.

English observers have not put on record very many or lengthy articles on the subject, whereas foreigners (amongst whom are particularly to be noted the names of Colin and Siedamgrotsky) have been much more active in this respect. In the time of the cattle plague

Professor Gamgee drew attention to the value of the thermometer as an aid to diagnosis, and since then there have appeared in the Journals articles bearing on this subject from Dr Fleming, Mr Geo. Armatage, Professor Robertson, Mr Singleton, and Mr Wm. Willis.

Captain Fred Smith, in his valuable work on "Animal Physiology," acknowledges a large amount of his information on the subject to Siedamgrotsky and Colin, thus showing, I think, that there is a gap in English veterinary literature upon this particular point; it is with the desire of helping to fill up a small portion of that gap that I excuse myself for placing before the profession the undermentioned observations, which have been collected chiefly during 1895 and 1896. In all cases recently Kew-tested thermometers were used, and the animals selected for observation were apparently in perfect health.

Influence of Length of Thermometer.

The length of the clinical thermometer in most general use is 4 inches, while others are 5 or 6 inches. The distance to which the thermometer is inserted makes a very appreciable difference, sometimes even as much as a degree, as the following observations will show:—

(1.) A 6 inch thermometer was introduced into the rectum of a cow for 4 inches (the length of an ordinary clinical thermometer) and allowed to remain for two-and-a-half minutes; this gave a register of 101·2°. It was then introduced the full 6 inch length and registered 101·5°.

(2.) The vaginal temperature was then taken in the same way, the 4 inch length being taken first, and the result 101·7°; immediately afterwards the 6 inch length was taken and registered 102·4°.

(3.) A 6 inch thermometer when introduced into the rectum of a sheep for 4 inches registered 102·8°; when introduced immediately afterwards to full length it registered 103·1°.

Thinking that perhaps the excitement induced by the act of taking the temperatures (as two-and-a-half-minutes exposure was allowed each time) might be the cause of this rise, the 6 inch length was taken first, but the result was only a confirmation of the above.

(4.) About four or five minutes after observation No. 3, the thermometer was again introduced into the rectum of the same sheep, the 6 inch length being taken first; the result was 103·6°; it was then introduced for 4 inches and registered 102·5°.

Immediately afterwards the proceeding was repeated, but reversed, the 4 inch length being taken first and registering 102·6°, the 6 inch length taken afterwards being 103·7°.

(5.) Cow, taken with a 6 inch length registered 102°; immediately afterwards with a 4 inch length 101·2°.

(6.) Dog, taken with 6 inch length registered 102·7°; immediately afterwards with 4 inch length 101·5°.

(7.) A sheep, taken with a 4 inch thermometer of the pattern which fits into the case by a bayonet joint, and so enables one to introduce it further into the rectum, gave (when the thermometer was inserted 5 inch length) 103·7°; immediately afterwards at ordinary 4 inch length 103·2°.

(8.) Dog, taken with a non-registering thermometer, inserted to

6 inch length, gave a temperature of 101·8°; when withdrawn so as to represent 4 inch length 101·4°; when replaced to 6 inch length 101·8°; this was repeated several times, the results always being similar to the above.

Variations between Rectum, Vagina, and Mouth.

For convenience and safety, both of the instrument and operator, it is customary to take the temperature of our patients per rectum or per vaginam, although occasionally it is taken between the lips and gums. When taken in the latter place it is, as might be expected, lower than when taken per rectum, the average being from one to two degrees; when taken per vaginam the temperature is usually about ·2 below that of the rectum, although this rule is not constant. In œstrum the temperature of the vagina is generally thought to be higher than that of the rectum, but this, again, is not always the case throughout the whole period, and it makes an appreciable difference as to whether they are taken together or consecutively, as the excitement or struggling (if any) exhibited during the act of taking will perceptibly raise the body temperature.

The following observations will illustrate the difference between the temperature in the rectum and the mouth; in the latter case the thermometer was inserted as far as possible between the sides of the lips and gums, and the mouth kept closed.

Sheep,	rectal	temperature	103·9°;	registered	in the mouth,	103·0°
„	„	„	104·0°;	„	„	103·2°
Cow	„	„	101·8°;	„	„	99·8°
Horse	„	„	100·4°;	„	„	99·8°
Dog	„	„	102·4°;	„	„	100·3°
„	„	„	102·0°;	„	„	99·0°
„	„	„	101·5°;	„	„	100·9°
„	„	„	100·9°;	„	„	99·5°

It is scarcely needful to remark that the introduction of cold fluids into the mouth a short time before taking the temperatures would make a much greater contrast; for example, a dog which had some cold fluid poured down its throat registered immediately afterwards, rectum 102°, mouth 95·7°. In another similar case the rectum was 102·6°, and mouth 97·4°.

The following will be sufficient (there are other observations in various parts of the paper) to illustrate the difference between the vagina and rectum, the latter being taken first unless otherwise mentioned.

[TABLE.

Animal	*Rectum*	*Vagina*	*Remarks*
Mare	100°·5	100°·0	...
”	101·1	101·1	...
”	100·4	100·2	...
”	100·6	100·4	...
”	100·0	99·9	...
”	100·2	100·0	...
Cow	101·5	101·5	Rectum taken again immediately, 101·5
”	102·4	102·1	...
”	100·9	100·6	Average of morning observations on sixteen consecutive days
...	101·4	101·2	Average of evening observations, same cow
”	101·8	101·5	Average of morning observations on seventeen days
...	102·2	102·0	Average of evening observations, same cow
”	100·5	100·8	Average of thirteen observations on eight days
”	102·4	102·2	...
...	102·6	102·4	Same cow taken again immediately, vagina first
”	102·0	101·0	...
...	102·1	102·0	Same cow taken again immediately, vagina first
Calf	102·4	102·0	Taken together, two equal thermometers used
”	102·8	102·6	Do., do.
Bitch	101·3	100·7	Do., do.
”	101·2	101·0	Do., do.
”	101·5	101·0	Rectum first, one thermometer used
”	100·8	100·8	Do. do.
”	100·4	100·8	Do., taken twice with same result
”	100·2	99·8	Do. do.
”	101·6	101·4	Average of twenty observations made on consecutive days

The following animals were taken whilst in œstrum.

Animal	*Rectum*	*Vagina*	*Remarks*
Mare	100°·4	99°·8	Taken twice
"	100·2	100·2	...
Bitch	102·6	102·4	...
"	101·2	101·4	...
Cow	100·1	100·8	The temperatures being taken together
Same Cow	100·6	101·2	The temperatures being taken together three minutes later, and the thermometers reversed

Cow.

Date	*Time*	*Temp. of Rectum*	*Temp. of Vagina*	*Remarks*
1896 Jan. 3	12.10 P.M.	101°·8	101°·5	Both taken at same time with tested thermometers
	10.30 P.M.	101·2	100·8	Both taken together; temperature of cowhouse 55°
" 6	9.0 A.M.	99·9	101·0	Taken together; temperature of air 38°, of cowhouse 43°. Animal ruminating; in œstrum
		100·0	101·2	Taken again at once, the thermometers being reversed
		100·8	101·4	Thermometers again changed and the temperature taken immediately
" 7	10.0 A.M.	99·8	100·2	Animal in œstrum; temperatures taken together
	...	100·0	100·5	Thermometers reversed and temperature again taken immediately. Temperature of air 36°, of cowshed 40°
" 8	10.0 A.M.	101·8	101·4	Animal in œstrum, ruminating, about ten minutes after milking. Temperature of air 42°, of cowhouse 45°
		101·8	101·4	Thermometers reversed and temperature taken immediately
" 9	11.0 A.M.	99·3	100·0	Animal in œstrum; temperatures taken together
" 10	1.0 P.M.	101·2	101·6	In œstrum; temperature of air 35°, cowhouse 42°; the rectum taken first, then vagina, and lastly rectum again

Date	*Time*	*Temp. of Rectum*	*Temp. of Vagina*	*Remarks*
Jan. 15	11.0 A.M.	100·1	100·8	In œstrum; temperatures taken together
„ 16	11.0 A.M.	100·0	99·8	Temperatures taken together; animal not shewing any signs of œstrum

Temperature of the Horse at Rest.

The average normal temperature of the horse at rest is considered by various authors to be as follows:—

Captain Fred Smith 100°; Armatage, 99 to 99·6°; Williams, 99 to 102°; Colin, 99·5 to 100·4°; Siedamgrotsky, 100·4°; Flemming, 101·7°; Davy, 99·5°; Sonnenberg, 99·2°: Provost and Dumas, 98·2°.

The above, as will be seen, show some differences of opinion; Smith and Siedamgrotsky also state that the temperature varies during the day and is slightly higher in the evening than the morning.

The undermentioned observations were made upon these points:—

Out of the temperatures of 212 quiet horses of different classes, sexes, and ages, which had been at rest for at least an hour previously:—

1	registered	between	97·0	and	98·0°
3	„	„	98·0	„	98·0°
11	„	„	99·0	„	99·5°
44	„	„	99·5	„	100·0°
96	„	„	100·0	„	100·5°
47	„	„	100·5	„	101·5°
10	„	„	101·0	„	101·5°

In the above list it will be noticed that the majority ranged from 100 to 100·5° but that a large proportion also registered between 99·5 and 100° and between 100·5 and 101°; the average was 100·3°.

Out of 49 horses taken between 5.30 and 8 A.M.:—

3	ranged	between	99·0	and	99·5°
14	„	„	99·5	„	100·0°
19	„	„	100·0	„	100·5°
12	„	„	100·5	„	101·0°
1	registered		101·2°		

Out of 16 horses taken between 9 A.M. and 12 noon:—

1	registered 99·9°			
10	between	100·0	and	100·5°
4	„	100·5	„	101·0°
1	pregnant mare			101·4°

Out of 62 horses taken between 12 noon and 6 P.M.:—

5	registered	between	99·0	and	99·5°
13	„	„	99·5	„	100·0°
27	„	„	100·0	„	100·5°
17	„	„	100·5	„	100·7°

Three horses kept in loose-boxes at the College, for the temperatures of which I am indebted to Mr F. W. Dowell, gave the following results :—

No. 1. Taken at 10 A.M. for twenty consecutive mornings averaged 100·1° ; the lowest being 99·2 and the highest 100·4°.

No. 2. Averaged 100·3 ; the lowest being 99 and the highest 100·5°.

No. 3. Averaged 99·7° ; the lowest being 98·8 and the highest 100·4°.

Taken at 10 A.M. and 5 P.M., for four days the morning and evening temperatures were as follows—

No. 1.		No. 2.		No. 3.	
Morning.	*Evening.*	*Morning.*	*Evening.*	*Morning.*	*Evening.*
99·8°	100·3°	99·8°	100·3°	99·7°	99·8°
100·4	100·2	99·8	99·7	99·1	99·8
100·2	100·6	99·4	100·0	99·5	100·0
99·8	100·5	99·0	100·4	99·8	100·0

Six horses, kept at rest, upon which numerous observations were made twice or three times daily during periods of from three to ten days, gave the respective averages of :—

100·1°, 100·5°, 100° 100·4°, 100·3, 99·6°.

The following show a distinct peculiarity of low temperatures, due probably to the coldness of the atmosphere, and the extreme age and poorness of condition of the subjects :—

Cart horses at a farm in Cambridgeshire ; temperature of air 40° ; all in poor condition, especially No. 7, but apparently healthy ; not clipped, had long winter coats on ; diet, oats and hay.

Sex.	*Age.*	*22nd Dec. 1895. 3.30 p.m.*		*24th Dec. 1895. 1.30 p.m.*	
		Temp.	*Remarks.*	*Temp.*	*Remarks.*
Gelding	12 years	100·0°	Been at plough till 2.0 P.M. ; stable hot and stuffy ; animals now feeding	...°	...
,,	15 ,,	98·1	Do.	99·5	Whilst at plough on stiff land ; bitterly cold wind ; sweating
Mare	10 ,,	100·4	Do.	99·5	Sweating
Gelding	7 ,,	100·3	Do.	97·8	Not sweating
Mare	25 ,,	100·0	Do.	98·4	Sweating
,,	15 ,,	99·8	Do.	100·1	Not sweating
Gelding	16 ,,	97·4	Do.	99·5	Do.
,,	12 ,,	101·3	Do.	...	...
Mare	5 ,,	98·9	Do.	100·8	Do.
,,	9 ,,	101·1	Vagina 101·1°	..	Do.
Gelding	16 ,,	98·8	Was at light carting work ten minutes before	...	Do.

Other horses at plough in same field, 24th December, at same time.

Sex.	*Temp.*	*Remarks.*
Gelding	96°·4	Not sweating (taken twice); a very old animal
„	96·7	Sweating do. do.
„	100·2	Do.
„	98·8	Do.
„	97·8	Do.

Influence of Exercise.

In order to watch the effect of exercise, which is said by Siedamgrotsky to increase the temperature, the following observations were made:—

Out of the temperature of 28 cart horses, taken immediately after *light* work:—

8	registered between	100·0	and	100·5°
11	„ „	100·5	„	101·0°
5	„ „	101·0	„	101·5°
2	„ „	101·5	„	102·0°
2	„ „	102·0	„	102·5°

30th May 1896. Temperature of air 65 to 68°.—Thirteen omnibus horses, averaging from seven to ten years of age, taken immediately after fast work consisting of a journey of about 12 miles; most of them sweating profusely and respiration much accelerated.

The lowest was 102·3, the highest 105·4°, whilst of the remainder 8 were between 102·5 and 103·5°, and 3 were between 104 and 105°.

June 1896. 6 to 7 P.M. Temperature of air 70°.—Fourteen omnibus horses averaging from seven to ten years of age in another stud, taken immediately after fast work consisting of a journey of about 14 miles. All were clipped, all sweating, and respiration much accelerated.

The lowest was 101·8, the highest (of which there were 2) 105°.

4	registered between	102	and	103°
4	„ „	103	„	104°
3	„ „	104	„	105°

13th June 1896. 4.30 to 6.15 P.M. Temperature of air 80°.—Twenty-nine omnibus horses in the same stud and under same conditions as above, all sweating, most of them very profusely.

The lowest was 102·1, the highest 106·5°.

8	registered between	103	and	104°
10	„ „	104	„	105°
7	„ „	105	„	106°

1st August 1896. 5 to 6 P.M. Temperature of air 75°.—Fifteen omnibus horses, in same stud and under same conditions, all sweating profusely and with accelerated respiration.

The lowest was 102, the highest 107°.

7 registered	between	102	and	103°
2 ,,	,,	103	,,	104°
4 ,,	,,	104	,,	105°
1 ,,	,,	105	,,	106°

In order to see whether these temperatures remained so high for any great length of time the following observations were made on the above-mentioned 15 horses.

Number.	*Sex.*	*1st August, 5-6 p.m.*	*1st August, 9-10 p.m.*	*2nd August, 7-8 a.m.*
1	Gelding	102°0	100°6	100°2
2	Mare	104·4	100·3	99·5
3	,,	103·4	100·0	100·1
4	Gelding	102·3	100·7	99·6
5	,,	104·0	101·8	101·2
6	,,	104·0	102·2	100·3
7	,,	102·6	100·3	100·8
8	Mare	104·0	100·5	100·4
9	Gelding	103·2	101·1	100·4
10	Mare	105·1	100·2	99·7
11	Gelding	102·3	101·1	100·3
12	,,	102·6	100·1	99·7
13	,,	102·4	100·4	99·9
14	,,	107·0	105·9	100·6
15	,,	102·7	107·0	100·2

Between 9 and 10 P.M. some of the horses were dry, others still sweating slightly; the temperatures of the stable varied from 75 to 80°. Between 7 and 8 A.M. all were dry. All the animals had eaten their food heartily and seemed all right.

It is worthy of notice that in most cases it took more than three hours for the temperature to fall to a point between 99 and 101°. Upon enquiry I was informed by the foreman of the stud that none of them had shown any sign of illness for at least three months.

18th December 1896. 6 P.M. Temperature of air 33°.—Twenty-five omnibus horses in the same stud and under the same conditions

as above; four were sweating profusely and the remainder not sweating at all. In none of them was respiration at all distressed, although, of course, somewhat accelerated.

The lowest was 101·8, the highest 104°.

12 registered	between	102	and	103°.
9 „	„	103	„	103·5°.
2 „	„	103·5	„	104°.

Summarising the above it will be seen—

(1.) That the average temperature of the horses at rest lies between 100 and 100·5°, but that a large proportion also come between 99 and 100°, and also between 100·5 and 101°; the average is 100·3 and a fair average range to take is between 99 and 101°.

(2.) That light work or slow exercise only causes a slight rise of temperature, say an average of from one to two degrees.

(3.) That prolonged violent or fast exercise in hot weather, even when accompanied with profuse sweating, produces a very much greater rise, about three degrees being a fair average to take. The very high temperature reached by omnibus horses in hot or muggy weather has been noticed in the columns of the *Veterinary Record* by Mr Willis and several other writers, and I have on several occasions heard it spoken of; I am at a loss to attribute it to any particular cause, as the animals certainly appear to be healthy in the ordinary sense of the term, and do a great deal of very hard work. Although I have repeatedly tried to get the same amount of rise in saddle and carriage horses by keeping them at a fast trot, canter, or gallop for long distances, I have never yet succeeded; in these latter cases the average has been a rise of about three degrees from what the temperature was at the commencement. I have thought that it might be owing to the amount of maize given as food with other corn to these omnibus horses, because in all the saddle and carriage horses experimented with no maize was allowed, other grains being preferred; I have not been able to experimentally follow this up to a definite conclusion. At a Central Veterinary Medical Meeting in June last Vet.-Captain Blenkinsop drew attention to the fact that horses not in condition when put to work in a hot sun frequently registered 105° and on the following morning would be normal. In the case of the omnibus horses here mentioned all (except two) had been at the same work for at least three months, and the temperature of these two was not materially different from that of the others.

(4.) That sweating, when produced in an animal at work, does not always produce an appreciable fall unless the muscular exercise is stopped; this is also shown in some of the undermentioned experiments.

With the object of still further testing the effect of muscular exercise and the part it plays in causing an increase of temperature, the following observations upon various kinds of animals were made:—

[TABLE.

Date.	*Time.*	*Rectal Temp.*	*Remarks.*
1896		°	
Jan. 2	3.38 P.M.	99·5	Hackney mare, seven years. Temp. of air 57°
	3.58	100·7	After being ridden at sharp trot; sweating and lathering profusely
Jan. 4	2.40 P.M.	100·2	Same mare. Temp. of air 44°
	2.49	100·5	After slow trot; warm, but not sweating
Jan. 6	2.35 P.M.	99·0	Same mare. Temp. of air 38°
	2.43	99·2	After exercise; being led at walking pace
Jan. 7	2.45 P.M.	99·2	Same mare. Temp. of air 37°
	3.0	101·3	After exercise at gallop; sweating profusely
Jan. 8	2.25 P.M.	99·8	Same mare
	2.50	101·4	After exercise at gallop; sweating and lathering profusely
Jan. 13	2.46 P.M.	99·8	Same mare
	3.5		Commenced to gallop on exercising ground
	3.8	99·8	...
	3.14	100·8	Just beginning to sweat
	3.22	101·8	Sweating and covered with lather in places
Jan. 14	2.38 P.M.	100·1	Same mare. Starting for brisk trot
	3.14	101·7	Sweating and lathering in places
Jan. 17	2.31 P.M.	99·4	Same mare. At rest
1895			
Nov. 29	12.30 P.M.	99·7	Very quiet hackney gelding. Well kept but not in hard condition. Had long winter coat. Was fed at 10 A.M.
	3.43	99·5	Temperature of atmosphere 52°
	3.44		Taken on exercising ground and kept at gallop for three minutes
	3.47	99·8	Continued exercise at sharp trot for twelve minutes longer
	3.59	101·4	Sweating profusely; taken back to loose-box
	4.25	101·4	Kept at rest and quiet
	6.30	99·6	...
	8.30	100·0	...
1896			
Jan. 1	4.6 P.M.	100·3	Cob, healthy, before exercise. Temperature of atmosphere 50°
	4.25	101·8	After sharp trot on exercising ground, sweating
Jan. 17	3.25 P.M.	100·4	Hackney gelding; before exercise
	3.45	102·5	After cantering exercise, warm but not sweating
Jan. 2	3.10 P.M.	100·2	Cab horse, before casting for neurectomy
	3.25	100·6	Immediately after casting
	3.45	100·8	After one nerve had been excised; not much struggling
	4.15	100·4	After other nerve was excised; scarcely any struggling
Jan. 2		101·2	Cart horse, before commencing to fire the hock
		101·0	After operation was completed, about twenty minutes later; there had been no struggling whatever, and no apparent excitement

Date.	*Time.*	*Rectal Temp.*	*Remarks.*
Jan. 15	3.21 P.M.	100·2	Aged cab mare, before casting to apply actual cautery to hock
	3.24	101·0	Struggled when cast
	3.33	101·0	...
	3.45	101·1	Vagina 100·4° (taken after rectum). Operation finished. Had struggled at intervals
Nov. 23	4.5 P.M.	101·0	Cab gelding, six years, taken whilst adjusting the hobbles
	4.9	101·6	When cast; struggled violently before operating
Nov. 25	3.45 P.M.	100·2	Excitable, nervous cab horse. Before casting
	3.48	100·7	When cast; struggled violently
Jan. 4	2.32 P.M.	100·5	Cab mare, nine years, before casting for neurectomy
	2.40	100·7	Was cast very quietly
	3.0	100·7	After one nerve had been severed; had been very quiet, and only struggled three or four times
	3.15	101·6	After operating on the other nerve; she had struggled violently several times whilst the other nerve was being sought for and cut

July. At farm in Bedfordshire; temperature of air 90°. Brown trap gelding, good condition, summer coat; fed on oats and hay.

Time.	*Remarks.*	*Temp.*
11.0 A.M.	In stable; had been at rest about eighteen hours	100·8°
11.7	After about a mile, trotting fast; not sweating at all	100·8
11.17	After trotting for ten minutes longer; beginning to sweat; respirations not at all distressed	101·8
11.45	After walking quietly for about a mile, and standing still in the sun for five minutes; not sweating now	101·8
12.5 P.M.	After a sharp trot of twenty minutes; sweating slightly; respirations not at all distressed	102·3
3.10	After standing quietly in the stable since the last observation, and eating a feed of corn	100·4
4.40	After five miles steady trotting, and then fifteen minutes rest in the stable	101·8
6.30	After being at rest in the stable about one-and-a-half hours	100·4

March. Bay mare. Not clipped. Not in hard condition. Temperature of air, 47°.

3.10 P.M. Temperature, 100·2°. Commenced slow, steady trotting exercise.

3.15. Temperature, 100·5°.
3.20. Temperature, 101·5°.
3.25. Temperature, 102·2°.
3.30. Temperature, 102·4°. Beginning to sweat.
3.35. Temperature, 103·2°. Sweating in patches.
3.40. Temperature, 103·4°. Sweating in patches. Commenced walking.
3.45. Temperature, 103°. Getting dry.
Piebald pony. Temperature of air, 47°.
2.53 P.M. Temperature, 100·4°.
3.7. Commenced steady trotting exercise.
3.12. Temperature, 100·4°.
3.17. Temperature, 100·2°. Beginning to sweat.
3.22. Temperature, 100·8°. Sweating all over the body.
3.27. Temperature, 101°.
3.32. Temperature, 100·6°. Becoming cooler.
3.38. Temperature, 100·8°. Sweating again. Allowed to walk.
3.43. Temperature, 101°. Body cooler and becoming dry.

Date.	*Hour.*	*Rectal Temp.*	*Remarks.*
1896. Jan. 18	10.30 A.M.	100°·5	Roan hackney gelding, four years old; coat had been clipped once, and was now about half grown again. Had been fed well, but was not in hard condition. Temperature of air 48°. Temperature of loose-box 50°
	11.30	100·5	...
	12.30 P.M.	100·6	...
	2.0	100·5	...
	2.37	...	Taken to sharp trotting exercise till 2.55
	2.55	102·2	Sweating; lathering between legs, and where bridle rubbed
	3.10	101·8	Quiet in loose-box
	3.30	101·2	Coat wet in places
	3.45	100·8	Coat fairly dry
	4.40	100·8	Drank about three or four gallons of water
	5.0	100·2	Was eating hay

September 1896. A mare whose average temperature at rest was 100·1° after half an hour's slow canter (sweating under the saddle) registered 101·6°; on the next day, after three quarter of an hour's smart trot and canter (sweating in patches), 102·3°; and a few days later, after two miles sharp trot and canter, 101·9°; and after five miles at the same pace, 103°, sweating only under the saddle.

October. 7 to 8 A.M. Temperature of air 27°, cold and frosty.—Foxhound bitches not yet fed; the temperatures were taken, after which the animals were made to follow a trail for about half a mile, occupying about two minutes in doing so; immediately upon their return the temperatures were taken again. A Kew-tested half-minute thermometer was used, but was allowed in each case from one and a half to two minutes' exposure.

Age.	*Temp. before.*	*Temp. after.*
Four Years	100°·6	101°·4
„ „	102·0	101·6
Two „	101·0	101·8
Five „	101·5	102·0
Two „	101·5	102·4
Two-and-a-half-Years	101·2	102·2
Two Years	101·1	102·1
Three „	101·6	102·0
Ten „	101·2	102·0
Five „	101·3	102·1

It will be seen from the above table that in each case, except No. 2, the temperature was increased.

[TABLE.

Observations on an Irish terrier bitch, two-and-a-half years old. Rectal temperature taken first unless otherwise specified.

Date.	*Time.*	*Temp. of Air.*	*Remarks.*	*Temp. of Rectum.*	*Temp. of Vagina.*
Nov. 8	10.0 A.M.	55°	Wet day. Bitch in œstrum; in kennel	102°6	102°4
,, 13	11.0	54°	Fine day. Do. do.	101·2	101·0
	4.0 P.M.	...	Do. do.	101·0	100·2
,, 14	8.30 A.M.	54°	Do. Before feeding or exercise	101·6	101·3
	9.0 P.M.	...	...	101·4	100·8
,, 15	8.10 A.M.	47°	...	100·4	99·6
	8.30	...	After twenty minutes sharp exercise	102·6	102·0
	10.0 P.M.	...	...	101·3	101·0
,, 16	8.30 A.M.	60°	...	101·2	100·8
	8.50	...	After ten minutes sharp exercise during which she passed fæces once, and urine three times	102·9	102·8
	7.30 P.M.	...	Rectum first, then vagina (two minute thermometer used)	100·7	100·7
			Taken again immediately in same order	100·9	100·9
			Between lips and gums; lips closed, 99·5	...	...
	8.10 P.M.	...	After twelve minutes sharp exercise	102·4	101·2
			Between lips and gums; lips closed, 100·3	...	...
,, 17	11.25 A.M.	50°	Rectum first, vagina second (two minute thermometer)	100·2	100·6
			Rectum again at once	100·4	...
			After twenty-five minutes sharp exercise during which she passed fæces twice and urine five or six times	102·6	102·6
	8.0 P.M.	...	...	101·6	101·6
,, 18	8.30 A.M.	37°	Foggy morning, very cold	99·8	...
	8.0 P.M.	40°	Foggy evening. Had been at rest all day	100·5	100·3
,, 19	8.0 A.M.	42°	Frosty. Had been quiet all night	100·4	100·2
	8.15	...	After twelve minutes sharp exercise	102·5	102·1
Jan. 4	12.30 P.M.	...	In kennel at rest. Both taken together (two thermometers used)	101·4	101·0
	12.35	...	After five minutes sharp exercise. Both taken together (two thermometers used)	102·8	102·4
,, 11	1.12	...	In kennel, quiet. Vagina taken after the rectum	100·8	100·5
	1.30	...	Temperature of kennel 54°. Taken again after five minutes gentle exercise	102·4	02·2

Date.	*Time.*	*Rectal Temp.*	*Remarks.*
Nov. 19	12.22 P.M.	101°·8	Dog, before being placed on operating table
	12.25	102·8	After being secured and struggling
Oct. 17	12.38 P.M.	101·4	Cat, before securing
	12.44	102·0	After placing on operating table and struggling
Dec. 5	5.8 P.M.	101·8	Toy bull-terrier, before securing
	5.11	102·5	When secured on operating table; struggled very much
May 29	3.40 P.M.	101·2	Aged collie, before securing
	3.43	101·6	When secured
Nov. 19	12.22 P.M.	101·8	Cat, two years, before securing
	12.25	102·8	When secured
Oct. 16	11.16 A.M.	103·0	Dog, very excitable, before securing for operation
	11.38	105·0	After had been struggling on operating table
Nov. 18	1.15 P.M.	101·4	Fox-terrier, before securing
	1.33	103·4	After struggling
Jan. 3	11.0 A.M.	102·2	Blenheim spaniel, before securing
	11.3	102·3	Was secured very quietly, and did not struggle at all
	11.9	102·4	Had been very quiet throughout
Nov. 23	5.0 P.M.	101·5	Fox-terrier, eight years, very fat
	6.45	103·2	After 12 miles run after a trap in Hertfordshire. Temperature of air 37°
Dec.	11.0 A.M.	100·2	Cat, excitable, half-minute thermometer
	11.1	100·4	...
	11.1½	100·6	...
	11.2	101·0	...
	11.3	101·6	...
Jan. 10	7.28 P.M.	102·2	Temperature of room 55°. Old English sheep-dog, before placing on operating table
	7.32	102·4	When secured
	7.36	102·8	Had struggled slightly
	7.48	103·4	Had struggled violently
Jan. 18	6.50 P.M.	102·0	Temperature of room 55°. Retriever, aged, before securing
	6.58	102·4	Had only struggled a few times
Nov. 30	9.20 A.M.	102·9	Female pig, three months, good condition, caught as quietly as possible
	9.24	103·5	After being placed on operating table with hobbles as quietly as possible, but animal struggled and squealed a great deal
	9.40 A.M.	104·0	Boar pig, three months, was excited and exercised by catching
	9.46	104·1	When fixed on operating table
	10.2 A.M.	104·2	Female pig, three months, was excited and exercised by catching
	10.6	104·5	When fixed on operating table

Three healthy sheep, in the Royal Veterinary College.

Time.	*Remarks.*	C *Rectal Temp.*	D *Rectal Temp.*	E *Rectal Temp.*
12.5 P.M.	Ruminating	103°·6	103°·3	102°·9
12.44	After taking the temperature; at 12.44 sheep C and E were taken out of the pens and raced about for exactly five minutes; D was left alone ruminating, but got excited, and made occasional attempts to jump his barrier and get to the others	104·2	103·0	102·8
12.50	C and E sweating very much under tail, in axillæ, and inside of thighs	104·4	...	104·7
12.58	Sheep D	...	103·7	...
1.5	C and E still sweating under tail	104·5	104·4	104·1
1.40	Ruminating; E in mouth (between lips and gum) 101·5°	103·1	103·3	103·2
2.20	Ruminating	103·4	103·1	103·2
3.50	...	103·4	103·0	102·9
10.15 P.M.	Lying down; taken very quietly.	103·2	103·2	104·0

Date.	*Time.*	*Rectal Temp.*	*Remarks.*
Nov. 28	4.0 P.M.	102°·6	Horned sheep, quiet. Was then driven sharply round a loose-box for one minute, the temperature being taken three minutes later. It then registered 102·6° as at first; unfortunately, owing to want of time, the temperature was not again taken
	...	102·0	Ewe, in same box, very quiet, was served in precisely the same manner, and taken two minutes after the horned sheep; the thermometer then registered 102·4°
Nov. 29	4.0 P.M.	103·2	Same horned sheep, at rest, feeding
	4.8	104·9	After being driven sharply around a yard for exactly five minutes; animal sweating profusely around tail and anal region, also under arms and thighs
	4.34	105·2	Feeding
	6.30	102·8	Quiet, at rest
	8.30	102·6	At rest and quiet
	4.0 P.M.	103·1	Same ewe as on 28th November. Vagina 103°
	4.6	104·1	Vagina 104·1°. After being raced about with horned sheep, as mentioned above. Sweating like the other
	4.32	104·1	Vagina 104·1°. Feeding
	6.30	102·6	Vagina 102·6°. Quiet
	8.30	102·4	Vagina 102·4°
Dec. 30	5.0 P.M.	103·4	Sheep, enclosed in a small stall. This animal was then frightened, and violently pulled about in this short space for three minutes
	5.4	103·8	...
	5.7	104·0	Taken quietly three minutes after this

30th November, at the College, pigs in good condition; three months old; temperatures taken in the same order as here placed.

Time.	*Sex.*	*Temp.*	*Remarks.*
9.20 A.M.	Female	102·9°	Caught as quietly and quickly as possible
9.40	Boar	104·0	Was troublesome to catch, and very excited
10.2	Female	104·2	Also troublesome and excited

Summarising the above, it will be seen that in all animals both exercise and excitement (which usually causes muscular exercise) play a very large part in causing a rise of temperature, and that this rise takes place rapidly and must always be taken into account when using the thermometer. Several observations also recorded show that the subsidence of temperature to what may be considered normal when at rest does not take place within any constant period.

Normal Temperature of the Ox.

The average normal temperature of cattle at rest is considered by various authors to be as follows:—

Colin, 100·4 to 101·3°; Armatage, 100·4 to 101·6°; Krabbe, 101·8°; Siedamgrotsky and Davy, 102°.

Out of 352 fat cows and oxen taken during the Smithfield Show, the late Professor Robertson obtained an average of 101·6°; 100 dairy cows taken by Mr Hugh Singleton gave an average of 101·5°.

The following observations were made on that point:—

24th and 25th May 1895. 7 to 10 P.M.—Thirty milking cows of various ages at farm in Sussex; all had been tested with tuberculin and had not reacted; all had calved within a month. The lowest was 101°, and the highest 103°, the average being 101·6°. A bull in the same byre registered 101·8°.

12th September 1896. 5.45 P.M.—Eight cows at farm in Herefordshire, immediately after milking, registered an average of 101·5°, the lowest being 100·8°, the highest 102·4°.

24th September 1895. 7 A.M.—Six fat animals at farm in Derbyshire. The lowest was 99·6, the highest 102·4°, the average being 101·1°.

September 1896.—Out of 49 milking cows taken at various times the lowest registered 99·5, the highest 102·8°; the average temperature was 101·5°. For these I am indebted to Mr Walter Stapley, M.R.C.V.S.

Milking cow, three years; temperature taken for sixteen consecutive days gave the following averages:—

10 A.M.	Rectum, 100·9°.	Vagina, 100·6°.
5 P.M.	„ 101·4°.	„ 101·2°.

The highest rectal temperature was 102·4°, the vagina being 102·0°.
„ lowest „ „ „ 100·0°, „ „ 99·8°.

Milking cow, six years old; temperature taken for seventeen consecutive days gave the following averages:—

10 A.M. Rectum 101·8°. Vagina, 101·5°.
5 P.M. „ 102·2°. „ 102·0°.

The highest rectal temperature was 103·0°, the vaginal being 102·4°.
„ lowest „ „ „ 101·0°, „ „ 101·0°.

Milking cow, in œstrum; thirteen observations made on eight different days gave as averages:—

Rectum, 100·5°. Vagina, 100·8°.

The lowest rectal temperature was 99·3°, the vaginal being 100·0°.
„ highest „ „ „ 101·8°, „ „ 101·4°.

Shorthorn cow.

Date.	*Hour.*	*Rectal Temp.*	*Remarks.*
1896 Jan. 18	11.0 A.M.	101·4°	Was fed with hay at 10.55 A.M.
	11.35	101·5	Ruminating
	12.35 P.M.	101·5	Resting quietly; lying down; not ruminating
	2.15	102·2	As at 12.35; not ruminating
	3.30	101·8	...
	4.30	102·4	Had kept water away since twelve o'clock; now gave a large bucketful (about 5 gallons), which was all taken
	4.50	102·3	...

In 13 calves, taken as opportunity offered, the highest temperature was 103·4, the lowest 101·1°, the average 102·4°.

Bull calf, eight or nine months, at the College; temperature taken twice daily (10 A.M. and 5 P.M.) for twenty-four consecutive days in November and December.

Of the morning temperatures, the lowest was 101, the highest 103·2°, and the average 102·2°.

In the evening the lowest was 101·4, the highest 103·1°, and the average 102·8°.

Summarising the above, it will be found that the average of the adult cattle is 101·3°, whilst that of the calves is 102·3°; of those that were taken both morning and evening, the morning average was 101·3°, and the evening 101·8°. A fair range for adults at rest would be 100 to 102°.

Normal Temperature of the Dog.

The average normal temperature of the dog at rest is considered by various authors to be as follows:—

Colin, 101·3 to 102·2°; Siedamgrotsky, 101°; Flemming, 101·3°; Krabbe, 101·6°; Armatage, in confinement 98·8 to 99·9°, at liberty 100·2 to 102·5°. The average of 100 dogs, taken by Mr Hugh Singleton, averaged 101·8°.

The following observations were made on dogs :—

26th October 1895. 10 to 11 A.M. At farm in Middlesex. Temperature of air 27°.—The temperature of 20 dogs, of various ages and breeds, which were loose in a shed; some of them were excited, as they had only been together for a few hours, and were strange to one another; the temperature of the shed was about 40°.

The highest temperature was 103·4, the lowest 101·4°, the average being 102·1°.

Ten bitches (ages from six or seven months to two years) loose in a shed averaged 101·9°, the highest being 103·8, and the lowest 100·5°.

Eleven dogs, aged between one and four years, chained up, averaged 101·8°, the highest temperature being 103·2, the lowest 100°.

Seven bitches chained up averaged 102·5°, the highest temperature being 103·2, the lowest 101·8°.

20th October 1895. 9.30 A.M. Temperature of shed 48°.—26 foxhound bitches and 2 dogs (of all ages) before exercise averaged 100·7°, the highest being 101·4, the lowest 99·9°.

26th October. 7 A.M. Temperature of shed 45°.—The temperature of 10 of the bitches whose average had amounted to 100·6° on the 20th was again taken, this time giving an averag 101·3°, the highest being 102, the lowest 100·6°.

Six dogs kept quiet in cages in the College upon which observations were made morning and afternoon during six consecutive days :—

No. 1.	Morning,	100·0°;	evening,	100·1°.
2.	„	99·4°;	„	99·9°.
3.	„	101·6°;	„	102·4°.
4.	„	100·7°;	„	101·5°.
5.	„	101·8°;	„	102·4°.
6.	„	101·3°;		

The highest morning temperature was 102, and the lowest 99·4°.
„ „ evening „ „ 103, „ „ 100·0°.

30th December 1895. Temperature of room, about 60°. Irish terrier pup, five months old, in kennel at the College, temperature taken for four consecutive mornings averaged 102·4°; the highest was 103, the lowest 102·2°.

Fox terrier bitch, about twelve months old, in kennel at College, temperature taken daily for eighteen consecutive days averaged 101·1°; the highest was 102·2, the lowest 99·8°.

Vaginal temperatures were taken on six occasions, the rectal temperatures on these occasions averaging 100·8°; the vaginal average was 100·5°.

The temperature of 22 dogs and bitches, of various ages and breeds, taken as opportunity offered, averaged 101·4°; the highest temperature was 102·5 and the lowest 100·8°.

5th December 1896. Temperature of shed 50°.—The average of 10 dogs and bitches of various ages was 101·9°, the highest being 102·8 and the lowest 101°.

The average of 89 unchained dogs and bitches, taken as opportunity offered between April 1895 and December 1896, averaged 101·6°, the highest being 103·2 the lowest 100·2°.

Date	Time	Temp.	Remarks
1896 Jan. 18	10.30 A.M.	101·1°	French poodle, dog, quiet in kennel; was not exercised at all
...	11.30	100·9	...
...	12.30 P.M.	101·2	...
...	2.0	101·3	...
...	3.30	101·6	...
...	4.45	102·0	...

It will be seen from the above observations on the French poodle, and also by some of those on other animals detailed in other parts of the paper, that the temperature does not remain constant for any length of time.

The following two experiments upon quiet dogs, made with a non-registering thermometer, also demonstrate this:—

Time.	Temperature and Remarks.	Time.	Temperature.
9.10	Thermometer inserted into rectum	8.10	101·4°
9.13	100·8°	8.14	101·2
9.15	101·0	8.15	101·2
9.17	101·2	8.18	101·4
9.18	101·4		
9.22	101·4		
9.29	101·2		
9.35	101·4		
9.37	101·4		
9.39	101·4		
9.42	101·2		
9.44	101·1		
9.45	101·0		
9.48	100·8		
9.50	101·0		
9.51	101·2		
9.52	101·2		
9.55	101·4		

Summarising the above, it will be seen that a fair average to take for the dog is 101·5°, and that a fair range of temperature is between 100·5 to 102·5°.

Normal Temperature of the Cat.

The cat is not an animal which has received so much attention as some of the others; Colin estimates the range to be from 101·3 to 102·2°.

The temperature of 41 cats (of various ages and both sexes), taken as opportunity offered, averaged 101·7°, the highest being 103·5, the lowest 100·2°.

From the observations made I think that a fair average and range to take is the same as in the case of the dog.

Normal Temperature of the Sheep.

The average range of temperature in the sheep is quoted by Capt. Fred Smith at 103 to 104°; Armatage, in confinement 102 to 103°, at liberty 104·5°; Banham 103°; Colin 101·3 to 104°; Siedamgrotsky 101·2 to 107·8°, giving 104·2° as an average; Flemming 104·4°; Krabbe 103·6°.

The following observations were made on that point:—

19th April 1895. 11.30 A.M. Temperature of air at farm in Berkshire 58°.—The temperature of 10 sheep, not shorn, at rest and ruminating, averaged 103·7°; the highest temperature was 104·2, and the lowest 103·2. In the evening 4.30 P.M., the average was 104·4°, the highest being 105·2, the lowest 104·2°.

On the next day 4 sheep of the same flock averaged in the morning 103·4 and in the evening 103·7°.

3rd June 1895. 4.30 P.M., at farm in Berkshire. Ewes immediately before shearing, hurdled together so as to be easily and quietly caught. The average was 103·4°, the highest 103·8, the lowest 102·8°

Two rams, very fat and able to walk slowly, registered 103·1 and 103·4°.

25th September 1895. Temperature of air 75°.—Eight animals, very excited and raced about before catching, averaged 104·4°, the highest being 104·8°, the lowest 104°.

26th September 1895. Temperature of air 75°.—Twenty Canadian sheep driven into a shed and taken as quietly as possible, although all were difficult to catch, averaged 104·2°, the highest being 105·4 and the lowest 102·6°.

Two other sheep of the same flock, after being raced about for ten minutes and jumping several obstructions, registered 106 and 106·4° respectively.

24th December 1895. 10 A.M. Temperature of air 40°.—Four fat sheep (eleven months old) gave the temperatures 103·6, 105·2, 104·6, and 106·4°; the first one was taken very quietly, but the other 3 were raced about for about ten minutes before being caught.

26th November 1895. 11 to 12 midday.—The average of 30 fat sheep which had been kept quiet in the same pen for about thirty-six hours was 103·8°, the highest temperature being 105·5, and the lowest 102·2°.

23rd November 1895. 10 A.M. Temperature of air 37°—A bitterly cold wind and showers of snow and sleet. A flock of pregnant ewes and one ram, caught very quietly, averaged 103·7°, the highest being 104·6, the lowest 102·6°.

Thirty-nine fat ewes and wethers hurdled closely and taken very quietly, averaged 104·2°, the highest being 105·4, and the lowest 102·8°.

November 1896. The average of 20 sheep hurdled about an hour before taking, and handled very quietly, was 104°, the highest being 104·6, the lowest 103·2°. For these I am indebted to Mr Walter Stapley, M.R.C.V.S.

July 1896. 11 A.M. Temperature of air 75°.—The average of 15 fat sheep hurdled quietly and allowed to stand for some time was 104·2°, the lowest being 104, and the highest 105°. For these I am indebted to Mr Graham Gillam, M.R.C.V.S.

December 1895. The average of 29 lambs varying from one to seven days old was 104°, the highest being 105·5, the lowest 102·9°. For these I am indebted to Mr Woollatt, a Class D student.

May 1896. 6 P.M. Temperature of air 68°.—Twenty-one wethers and ewes which had been at rest in the pen about an hour:—

Eleven shorn sheep averaged 104·5°, the highest being 105·8, the lowest 103·4°.

Ten unshorn sheep averaged 104·3°, the highest being 104·9, the lowest 103·3°.

September 1896. 2 to 3 P.M.—Fifteen fat sheep of various ages, taken very quietly after walking about 150 yards, all well used to being handled, without a dog. The average was 104·6°, the highest 105·8, and the lowest 104°.

Fifteen breeding ewes taken in the same manner averaged 104·3°, the highest being 105·5, and the lowest 103·5°.

May 1896. 3 to 4 P.M. Temperature of air 70°.—A flock of sheep (wethers and ewes), fetched very slowly from pasture and allowed to stand quietly for three quarters of an hour in a yard before commencing:—

Thirty-one unshorn sheep averaged 104°, the highest temperature being 105·6, and the lowest 103·2°.

Twelve shorn sheep averaged 103·9°, the highest temperature being 105, and the lowest 103·3°.

The temperature of 5 sheep aged between one and four years, kept very quietly in small pens, the temperature being taken in the morning at 10, and in the afternoon between 4 and 5, regularly from 9th November to 6th December 1895, and at intervals until July 1896:—

No. 1 averaged—

Morning	(24 observations),	rectal	103·5°.
„	(22 „),	vaginal	103·5°.
Evening	(21 „),	rectal	103·0°.
„	(19 „),	vaginal	103·0°.

In the morning the highest rectal temperature was 105·4, the lowest 102·6°. In the evening the highest 103·9, the lowest 101·6°.

No. 2	averaged	103·5°	out of	24 morning	observations.
	"	103·3°	"	22 evening	"
No. 3	"	104·2°	"	9 morning	"
	"	104·5°	"	10 evening	"
No. 4	"	103·8°	"	29 morning	"
	"	104·0°	"	32 evening	"
No. 5	"	103·7°	"	27 morning	"
	"	103·7°	"	25 evening	"

Out of these the highest temperature registered was 106·8, the lowest 102·4°.

Wether, Hampshire breed.

Date	*Time*	*Temp.*	*Remarks*
1896 Jan. 18	10.30 A.M.	103·1°	...
...	11.30	102·9	Lying quiet, not ruminating
...	12.30 P.M.	103·6	Lying quiet, not ruminating
...	2.0	104·2	Taken twice, rectum emptied by passage of fæces before taking temperature; ruminating
...	3.30	103·2	...
...	4.30	103·6	...

Summarising the above, it will be seen that they present great variations, but that a fair average temperature to take in adults is 104°; a fair range of temperature which will include the majority of them when at rest is from 103·4 to 104·4°. In taking the temperature of a flock of sheep it must not be forgotten that excitement and struggling (or other muscular exercise) will speedily cause a rise.

Normal Temperature of the Pig.

The temperature of the pig is given by various authors as follows:—

Armatage, in confinement 101 to 102·4°; at liberty 103 to 104°; Siedamgrotsky, 103·2° (four to six months old); Flemming, 104·9°; Krabbe, 102·3°; Gurlt, 104 to 106°.

The variations in range of temperature as given offer wide contrasts; this may probably be accounted for by the rapidity with which the temperature rises during the excitement and muscular activity, which are almost always present when attempting to use a thermometer on this animal.

12th October 1895. 3.30 P.M. Temperature of the pens 60°.—A number of pigs, three-and-a-half to four months old, being fattened in separate pens; the temperature of most of them was taken quietly;

those in pens, 1, 2, 3, and 6 were in good condition, those in pens 4 and 5 were poor.

Pen No.	1.	6	pigs	averaged	103·1°
" "	2.	6	"	"	103·0°
" "	3.	8	"	"	102·8°
" "	4.	6	"	"	101·8°
" "	5.	6	"	"	102·5°
" "	6.	7	"	"	101·3°

Two very quiet fat boars, two years old, registered 100·8 and 101·8° respectively.

25th September. 9 A.M.—The average of 8 fat pigs, nine months old, taken very quietly whilst feeding, was 102·4°

21st December 1895. 4 P.M., cold frosty air.—Pigs in sheds partially exposed; all in good condition, being fattened. Fed on barley-meal and corn-sweepings. Age about five months. At a farm in Cambridgeshire.

Sex.	*Temp.*	*Remarks.*
Female	102·8°	Taken very quietly; no excitement or struggling
Male	104·5	Was very excited, difficult to catch, and struggled a good deal
Do.	105·0	Do.
Do.	104·1	Do.
Do.	105·2	Do.

24th December. 11 A.M., cold, stormy day.—At another farm in Cambridgeshire. Pigs being fattened; about five months old; fed on pea, rye, and barley meals.

Temp.	*Remarks.*
103·2°	Taken after some little trouble, but not much exercise or excitement
103·5	As with No. 1
102·4	None of these showed any great objection to their temperatures being taken
102·7	
102·6	

Hermaphrodite, about eighteen months old, very quite to handle, taken per vaginam at 10 A.M. and 5 P.M. for three days averaged in the morning 101·5°, and in the evening 102·3°; the lowest temperature was 101·4°, and the highest 102·4°.

25th May 1895. 10 A.M.—9 pigs, aged fourteen weeks, troublesome to secure, averaged 103·6°; the highest was 104·8, and the lowest 102·9°.

October 1895. 7 A.M. Temperature of shed 40°.—Average of 3 fat pigs (eleven weeks) 104·4°; 3 breeding sows (two to four years) 99·7°.

November 1895. Temperature of shed 40°.—Seventeen fat pigs about five months old, troublesome to catch, averaged 104·5°; the lowest was 102·2 and the highest 106·6°.

Sow, three years old, standing very quietly to be taken, registered 101·3°.

Sow, five months old, standing very quietly to be taken, registered 102·2°.

October 1895.—The average of 15 pigs, taken by Mr Stapley, was 102·8°; the highest temperature was 103·8 and the lowest 101·9°.

December 1895.—The average of 9 pigs, about one month old and all objecting very much to have their temperatures taken, was 104°; and of 11 pigs six months old the average was 102·1°. For these I am indebted to Mr Hines of Class C.

From the foregoing observations the average temperature of pigs about six or eight months old when taken quietly is about 102·4°: a fair range to allow in young pigs is from 101·5 to 103·5°, but if much time be lost in catching the animal or there is much struggling such high temperatures as from 104 to 106° will speedily be reached. In old animals when at rest and taken quietly from 100 to 102° is a fair range.

Normal Temperature of Fowls, etc.

The temperature of the fowl is given by Colin as 108°, whilst Meade Smith and Wesley Mills give 107·6°.

The undermentioned observations give an average of 106·9°, and a fair range to take when considering them at roost and at liberty appears to be between 105·5 and 108·5°.

December 1895. 6 P.M.—Temperature of fowl-house 39°.—The temperature of 12 fowls (had been at roost about an hour and a half) registered an average of 106°; the highest temperature was 107, the lowest 105·1°.

November 1895.—The temperature of 18 fowls taken immediately after going to roost registered an average of 106·5; the highest was 107·1, the lowest 105·6°.

September 1896.—The temperature of 26 fowls taken after having been at roost about an hour registered an average of 107°; the highest was 108·6, the lowest 105·6°.

October 1896.—The temperature of 20 fowls taken about an hour and a half after going to roost averaged 106·8°; the highest was 108·5, the lowest 105·6°.

September 1895. 11 P.M.—Temperature of hen-roost 70°—The temperature of 16 fowls taken after having been at rest four or five hours gave an average of 106°; the highest temperature was 107·1, and the lowest 105°.

December 1895. 4 P.M.—The average temperature of 6 fowls taken whilst at liberty, somewhat troublesome to catch, was 107·8°; the highest was 109·2 and the lowest 107·8°.

September 1895. 11 A.M.—The average temperature of 13 fowls taken whilst at liberty was 108·2°; the highest was 109·4, the lowest 107·2°.

The average temperature of the duck is given by Colin at 107·8°.

The average temperature of 24 ducks, taken when at night fastened up and also when at liberty, averaged 107·8°; the highest was 109·4, the lowest 106·6.° One very excited animal registered 111°. The duck appears to have a temperature slightly higher than that of the fowl.

Of other birds taken at various times :—

An average of 17 smaller varieties (sparrows, linnets, etc.) gave 108·6°; the highest being 111, and the lowest 106·6°.

Having occasion in March, 1894, to test one of a large herd of ostriches with tuberculin, I took the temperatures of five others which were apparently in the best of health. The average temperature was 99·2° ; the highest being 100, and the lowest 98·5°.

One bird, upon which six observations were made at three hour intervals during the day, registered an average of 98·8°, the lowest temperature being 98·5 (at 9 A.M., 9 P.M., and 12 midnight), and the highest 99·2° (at 3 P.M.), whilst at 12 midday and 6 P.M. the temperature was 99°, thus illustrating again that the temperature is highest at the time when the body is most active.

Of other animals not considered as "domestic," 17 wild rabbits taken immediately after being shot gave an average of 103·6°; the highest being 105·1, and the lowest 102°.

An average of 8 ferrets gave 102·8° ; the highest being 104·4, and the lowest 100·3°.

The observations recorded in these pages were made in the town and country and in various parts of England ; the influence of district appears to play no part whatever in the result. I think that horses in towns average about ·2° higher than horses in the country. Sex appears to make no difference if the animal is a quiet one and easily handled. Age is an important factor, as it will be seen in the averages taken that those of the younger animals are slightly higher than those of older ones. This is well shown in the observations taken upon the calves and lambs.

The temperature of animals at rest, taken between 6 and 9 A.M. is slightly lower than when taken between 4 and 7 P.M.

The temperature of the external atmosphere certainly plays some part ; in hot, close weather the body temperature is slightly higher than in cold weather, and the rise caused by exercise is much more marked. This is well brought out in the following observations, which were made on the same omnibus horses in June and December. The time of day at which the observations were made was in each case about 6 P.M.—immediately on being taken out of the omnibus. The animals were receiving the same dietary, doing exactly the same day's work, and looked when at rest in exactly the same condition on each occasion, but whereas in June the horses were sweating profusely and breathing hurriedly, in December they were not sweating, and the respiration was quiet :—

Sex.	*13th June.*	*18th December.*
Gelding	104°·0	102°·4
Mare	105·0	102·8
Mare	104·0	102·4
Gelding	103·7	103·0
Gelding	104·2	103·7
Gelding	103·4	102·8
Gelding	103·0	103·6
Mare	104·6	103·2
Mare	106·5	104·0
Gelding	104·0	103·0
Gelding	104·0	103·4
Gelding	104·9	102·4
Mare	103·8	102·4
Gelding	104·0	102·8
Mare	105·0	103·1

The influences of food and drink are said by Siedamgrotsky to act antagonistically to one another; the ingestion of food slightly raising the temperature, whilst the ingestion of water lowers it. At various places amongst the above there are a few observations recorded upon these points which confirm the statement in regard to the drinking water, but in the case of the food I am of opinion that it largely depends upon the method by which the animal takes it; in animals like the horse or cow, which perform a certain amount of muscular exercise, there is a slight rise; but in the case of dogs which I have fed upon small pieces of meat, administered so that they were bolted without being chewed, the results have not been confirmatory.

For the opportunities of obtaining many of these statistics I am greatly indebted to several gentlemen, especiallly to Messrs Rogerson, Taylor, Willis, and Villar of London; Messrs Walter Stapley and George Upton of Dartford; and Mr Harold Sessions of Brighton, whose kindness in the matter I desire to acknowledge.

Literature.—"Veterinary Physiology," by Vet.-Captain Fred Smith; "The Thermometer as an Aid to Diagnosis," by George Armatage; "Traite de Physiologie comparée des Animaux," by Colin. *Veterinary Journal*, Vol. I., pages 128-131, translation of a paper by Siedamgrotsky on the thermometry of the domesticated animals; Vol. XX., page 311, "Records of Internal Temperature of Healthy Cattle," by the late Professor Robertson. *Veterinarian*, 1868, "The Thermometer in

Veterinary Medicine," by Dr George Fleming; 1888, "Internal Temperature of the Sheep," by Mr Hugh Singleton. *Veterinary Record*, 21st December 1895, "Physiological Temperatures," by Mr Wm. Willis; March and June, 1896, Report of the Proceedings of the Central Veterinary Medical Association.

VERMINOUS GASTRO-ENTERITIS IN CATTLE.

By J. M'FADYEAN, Royal Veterinary College, London.

A LITTLE more than six years ago, viz., in October 1890, in the first number of the *Zeitschrift für Fleisch und Milch-Hygiene*, Ostertag described what he regarded as a new species of strongyle encountered by him in the 4th stomach of the ox. The parasite was first met with in an animal slaughtered at the Berlin abattoir. This animal, a yearling bull, was much emaciated, and the connective tissue of the body was dropsical, but the only visceral lesions of any consequence were confined to the abomasum. The mucous membrane of this organ was swollen throughout, and closely beset with small circular, flat elevations of the epithelium, each of which showed a minute pin-hole opening at its centre. Microscopic examination of these elevations revealed the fact that each harboured a small nematode worm. Some of the parasites were not fully developed, but the majority were sexually mature, and both sexes were represented. Ostertag named this worm the strongylus convolutus, from its tendency to coil itself up in the mucous membrane. When the stomach was examined immediately after death Ostertag found that all the parasites were encysted in the mucous membrane, but if the examination was delayed until putrefaction had begun, then many parasites were found free on the surface of the membrane, having crept out of the little cavities in which they had been accommodated while their host was still alive.

The discovery made in the case of this bull led to a more minute examination of the abomasum in the cattle slaughtered at the Berlin abattoir, with the wholly unexpected result that the same parasite was found, though generally only in small numbers, in no less than 90 per cent. of all the cattle. Ostertag considered that this worm was probably the main etiological factor in connection with the so-called "cachectic dropsy," which had in Germany frequently been met with among young cattle.

The following is the description which Ostertag gives of the parasite:—

"They are small, cylindrical-shaped, and provided with a strong chitinous envelope, which is regularly transversely ringed. The colour of the worm is yellowish brown, and the females are somewhat darker than the males. The colour is due to small pigment granules in the intestine.

"The mouth is terminal, very small, and unarmed, being merely provided with a capsule-like thickening of the chitinous envelope. The œsophagus is short and its musculature strong; at the end of the œsophagus there is a slightly developed bulb. The intestinal canal is only slightly coiled. On

either side of the commencement of the intestinal tract there is a peculiar glandular structure.

"Length of the male, 7 to 9 mm.; of the female 10 to 13 mm. Thickness 0·12 mm. The males occur in smaller proportions than the females. The caudal end of the male shows a beautifully formed membranous bursa, the diameter of which is 0·22 mm., while from the end of the body to the point of attachment of the bursa measures 0·16 mm. The bursa is supported by somewhat slender ribs with a facetted structure. Ribs 3 and 6 reach as far as the point of attachment of the bursa, while 1 and 2 and 4 and 5 are fused superiorly. The posterior ribs at their hinder extremity run out into two small points and are provided with a lateral process.

"The spicula are double, dark yellow in colour, and have a length of 0·2 mm., and a breadth of 0·02 mm. They lie in a sheath, and show at their anterior extremity a small knob-like swelling, while towards the bursa they divide like the claws of a fowl. At the latter place one observes also short spiny outgrowths.

"The females are on an average larger, darker in colour, and more numerously present than the males. The ovarium is unpaired and contains a single row of eggs or rudiments of ova. The ripe eggs have an oval shape; in the uterus they lie obliquely, the one behind the other, and they show commencing division of their protoplasm. No further stage of development than this was observed within the body of the worm. From the vagina a uterus branches off forwards and backwards; the length of the uterus is on an average 0·16 mm. The uterus shows repeated sacculations, and is provided with a funnel shaped termination towards the ovary. The length of the vagina is 0·04 mm.; the vulva has a breadth of 0·04 mm., and opens outwardly with a funnel-shaped mouth.

"The vulva is covered by a bell-shaped fold of skin [and this is regarded as one of the most characteristic features of the parasite]. This fold has a length of about 0·2 mm., and its transverse measurement is the same. The anus is 0·16 mm. in front of the posterior end of the body. The tail ends in a slightly curved, sharp point."

Ostertag's description of the strongylus convolutus has been quoted at length in order to enable the reader to judge whether that parasite is identical with either of those which I shall hereafter describe.

In the *Veterinary Record* for 31st December 1892, Professor Penberthy published a short article entitled "Diarrhœa and Anæmia in Young Cattle," in which it is stated that in 1889 he had discovered small strongyles (of which he thought there were two varieties) in the 4th stomachs of young cattle affected with "obstinate diarrhœa and wasting of flesh." In this article it is not said whether either of the parasites belonged to a new species, and no description of them is given beyond the statement that they varied in length from a twelfth to a sixth of an inch. This, so far as I am aware, is the first reference in English literature to nematode worms of the abomasum as the cause of chronic diarrhœa in young cattle.

Four months later (22nd April 1893) a short note on "Anæmic Diarrhœa in Young Cattle," by Mr F. E. Place, of Honiton, appeared in the *Veterinary Record*. In this note Mr Place states that in the early spring of 1890 he was engaged with Professor Penberthy in investigating outbreaks of chronic diarrhœa in young cattle, and that he then discovered in the abomasum of a calf numerous "strongyle-like worms 1-3 centimetres in length." Similar worms were afterwards found in other subjects, and he named the parasite "strongylus

Placei," from which it may be inferred that the worm was thought to belong to a new species, though beyond the above statement as to its size no description of it was given.

To this Journal for September 1894, Professor Penberthy contributed, under the heading "Parasitic Gastro-enteritis, Diarrhœa, and Anæmia of Cattle," a valuable article, in which he dealt with the history, symptoms, etiology, morbid anatomy, and treatment of these conditions. Here, again, the author attributes great importance to the presence of minute strongyles in the 4th stomach as a cause of persistent diarrhœa and wasting, and the worm which appeared to occupy the first place in this respect was regarded as constituting a new species, the characters of which were given as follows:—

"Colour brownish, sexes distinct, males and females vary little in length, ranging from three-twentyfifths to six-twentyfifths of an inch. Taking a large number of specimens, the females are a little longer than the males, though occasionally males are found equal in length to the longest females. In the male the anterior extremity is pointed, the posterior provided with a bursa, in some cases giving the idea of being obscurely bilobed; in other cases the caudal pouch appears simple. This is supported by four ribs on each side, usually directed downwards and outwards; three long ones posteriorly placed, distinct from their bases, and the central bifid at its free extremity. At the anterior part two supplementary rays, distinct from the lateral, are directed upwards. Above the bursa is a retracted double spicule, dark and prominent. With the exception of the distinctly bilobed condition, the bursa is well represented in Neumann, p. 414, under the description of the caudal extremity of the male strongylus ventricosus. The text referring to the strongylus ventricosus, however, clearly proves that the worm, under my observation, is not the same. The female is pointed at each extremity; contains eggs of a comparatively large size, and a vulva near the posterior extremity. Associated with this strongyle, most frequently in the large intestine, I have found the strongylus ventricosus, easily distinguishable by its greater length and longitudinal ridges, etc. (which are not apparent in the foregoing). . . . That this worm is distinct from that described by Ostertag, under the name of the strongylus convolutus, appears plain from the greater length of the latter, the mouth of the male, the markedly bilobate bursa, the posterior rays, the size of the ova of the female, and the fact that Ostertag describes the habitat of this worm in the wall of the stomach."

In addition to the new species above referred to and the strongylus ventricosus, Professor Penberthy had seen in three rapidly fatal cases a third variety of worm, the species of which was not determined, though it was regarded as belonging to the *Anguillulæ*.

During the past four years I have had the opportunity to observe several outbreaks of what proved to be parasitic gastro-enteritis in cattle. With regard to the clinical history of these cases I have little to add to what has already been written on the subject. The constant symptoms were diarrhœa, emaciation, and anæmia. Sometimes the disease set in rather suddenly with violent diarrhœa and rapid loss of condition, while in others a period of unthriftiness preceded the onset of more acute symptoms. In some of the outbreaks only young animals (under two years old) fell victims, but on three of the farms cows of all ages were attacked. The disease had in all the cases been prevalent for several seasons, and some of the farms had

a reputation, extending back for many years, of being unhealthy for cattle. In one instance there was a tolerably clear history of the disease having been started by the purchase of a cow suffering from the complaint. The outbreaks occurred in counties as remote as Devon and Westmoreland, and on soils of the most varied character. In some of the cases the pasture was partly moorland, but in others the land was all arable. Young animals were not attacked as long as they were confined to the house and dry feeding, but among animals grazed out-of-doors cases occurred at all seasons of the year, and the history obtainable never made it possible to trace the disease to any particular field.

As a rule the disease was supposed to be "consumption," and in some of the cases this was the diagnosis made and adhered to by the veterinary attendant, although no lesions of a gross character had been discovered at the autopsy in fatal cases.

Cough was never a symptom of the disease, and the superficial lymphatic glands were not enlarged. The appetite was but little interfered with, and not rarely it was good up to the very last. The pulse, respiration, and temperature were not markedly abnormal.

As has already been mentioned, diarrhœa was one of the constant symptoms, but this could be temporarily or permanently held in check by the administration of astringent medicines. In general, however, this did not suffice to effect a cure in animals already markedly wasted, the emaciation continuing although the diarrhœa had been arrested, and in spite of a liberal diet. The duration of the illness varied considerably. Death sometimes resulted in a few weeks after the onset of decided symptoms, but in the case of animals housed and carefully attended to the animals sometimes survived for six months or more.

Lesions.—The *post-mortem* examinations of animals killed at an advanced stage of this disease affords but little variety in the seat or nature of the lesions. The normal adipose tissue of the body is conspicuous by its absence, and the blood is thin and watery. Sometimes there is more or less œdema of the connective tissue, and a moderate amount of dropsical fluid in the serous cavities. As a rule, however, in the cases that I have had an opportunity to examine, the emaciation was not accompanied by any notable degree of dropsy, either of the intermaxillary space, dewlap, or serous cavities.

In the majority of cases the mucous membrane has a pale anæmic appearance, and not infrequently this pallor is associated with marked œdema of the membrane. In such a case the spiral folds of mucous membrane are considerably thickened, and on section their textures have a clear gelatinous appearance.

In some cases, particularly those of the more rapid type in young animals, the mucous membrane of the abomasum shows more or less inflammatory congestion. In only one instance have I found the small flat elevations of the mucous membrane described in Ostertag's article. The subject in that case was a cow, and the parasite present in the stomach was the larger one of the two hereafter described (species No. 1). In two other cows from the same farm the same parasite was found in the abomasum on *post-mortem* examination, but no "worm tubercles" were present in the mucous membrane.

The mucous membrane of the small intestine in some cases shows

scattered patches of congestion, or even small petechial hæmorrhages, but as a rule the small bowel is normal. The large bowel, particularly the cæcum, is not rarely distinctly inflamed, and its mucous membrane may show numerous small hæmorrhages.

It has already been mentioned that the disease is frequently mistaken for tuberculosis, and it may therefore be well to state here that in only one instance have I found tuberculous lesions in association with this verminous gastritis. The exceptional subject was a cow, and the lesions were so slight as to make it impossible to ascribe the animal's illness to tuberculosis.

It remains in the next place to describe the two species of parasites which according to my own observations are the cause of gastritis in cattle in this country, and indeed, that is the main purpose of this article. At the outset of this part of the subject it may be observed that there is one method of describing such parasites that is much superior to any other, although, unfortunately, it has as yet been little employed, viz., photography. In the case of larger parasites, in which the features that distinguish different species are of a gross character, a word picture is generally quite sufficient for future identification. The parasites now under consideration, however, are too small to admit of their species being determined by the naked eye, and even under the microscope the specific differences between some of the smaller strongyles are by no means great. In such a case a description in words may with the best intention on the part of the writer fail to convey a correct idea of the object described. This defect of verbal description may be compensated for by the reproduction of accurate drawings, but illustrations produced in that way do not carry with them the stamp of absolute fidelity which belongs to a photograph. In the present case more reliance is placed on the illustrations than on the text which they accompany, as a means of fixing the characters of the parasites.

Species No. 1—In some outbreaks this species was found by itself, and in others it was accompanied by No. 2. As is the rule with parasites of this class, the female worms are present in excess of the males. There is also the usual disparity of size between the two sexes, the males being considerably smaller than the females. To the naked eye the colour of the worms is a dull white.

The females vary in length, but the average adult size may be set down at about 9 mm. Fig. 4, in Plate IV. reproduces the natural size of several worms taken at random, the one marked *a*, being a female and the others males. The diameter of the body measured a little in front of the vulva is from ·08 to ·09 mm., and from the neighbourhood of the vulva the body gradually tapers to the anterior extremity, while from the vulva backwards to near the tail it is almost uniform in thickness. The tail is slightly curved and terminated by a sharp point. The mouth is terminal, unarmed, and surrounded by a narrow blunt collar. The wall of the gullet is very thick in its posterior part, where it terminates in an intestine that runs straight through the body. The anus is distant about 0·14 mm. from the point of the tail. Two small spine-like papillæ with a backward direction are present on opposite sides of the body about 0·3 mm. behind the anterior extremity (Plate IV., fig. 1).

The orifice of the vulva is covered by a flap-like appendage of the

integument. The integument is crossed by fine transverse ridges, and it also shows on either side (upper or lower) of the body 10-14 equidistant longitudinal ridges (Fig 3). The uteri are directed backwards and forwards from the vagina, and contain a large number of eggs somewhat obliquely placed the one behind the other. The eggs measure about 0·07 mm. in length by 0·04 mm. in breadth. Those nearest the vagina show the morula stage of division.

The adult male worms are about 7 mm. long, and the body is thickest at its posterior end, and gradually tapers towards the head. The spicules are dark-yellow in colour, and 0·2 mm. long. The bursa, which is difficult to spread, measures 0·31 mm. across at its widest part (*see* Fig. 5). The posterior ribs spring from a median stem, and each divides into two very short thin branches. At its attached end the median stem of the posterior ribs sometimes appears cleft longitudinally, and it is flanked on either side by a delicate outward curved rod. The remaining ribs are all comparatively stout, and the postero-external and the anterior are double on each side. The bursal membrane shows fine striæ running at right angle to its free edge.

Species No. 2.—This worm is also dull white in colour. As previously mentioned, it has been found in association with the one just described, but in other outbreaks it was the only parasite present. It is distinguished from the one already described by its smaller size, and by numerous structural differences.

The adult female worms are from 3 to 4 mm. long, and 0·06 broad in front of the vulva. From the vulva backwards the breadth is maintained to near the tail, which runs out into a sharp point, and is almost straight. In front of the vulva the body tapers gradually to the anterior extremity, which has no collar or expansion. The integument shows very fine transverse but no longitudinal ridges. No neck papillæ are present. The anus opens 0·07 mm. from the tip of the tail. The vulva is distant 0·75 mm. from the posterior extremity, and it is unguarded. The uteri pass backwards and forwards from the vagina, and contain eggs of relatively large size. These are arranged lengthways, the one behind the other, and measure 0·07 long by 0·04 broad.

The largest males are a little over 3 mm. long, and at their posterior extremity they are about 0·06 broad. The body gradually tapers from the posterior extremity to the head. The spicules are 0·1 mm. long, and the bursa measures 0·125 to 0·18 across at its widest part. The posterior ribs spring from a long (0·06 mm.) tapering median stem, and are themselves extremely short, as each almost immediately divides into two short branches. The median stem thus appears under a low magnification to divide into four prong-like branches at its free end (*see* Plate IV., fig. 278). The postero-external rib is short, and the median is represented by two large branches separate down to their bases. The antero-external is of about the same size as the branches of the median, and the anterior is represented by two distinct ribs, the anterior of which is slender, and the posterior thick. Thus, omitting the posterior ribs, the bursa is supported on each side by six rays, of which the central four are nearly equal in thickness, while the outermost ones are shorter and more slender.

The question now arises, does either of these worms belong to a species

hitherto recognised as parasitic in the stomach of the ox? The worm before referred to as No. 1 is nearly the same size as that named the strongylus convolutus by Ostertag, but if the illustrations which accompany the text in Ostertag's article are correct, the two worms are not identical. The picture of the bursa there given is quite different from Fig. 5, Plate IV., and the form of the head in Ostertag's figures is also different. Furthermore, in Ostertag's description of the worm no mention is made of neck papillæ, or of the longitudinal ridges of the integument, which is simply said to be transversely ringed. Notwithstanding these discrepancies, I think it possible that the parasite encountered in the Berlin abattoir was the same as the first of the two worms described in this article, and I have therefore refrained from suggesting a new name for this species.

The second worm I cannot identify with any previously described species, and I venture to suggest for it the name *strongylus gracilis.*

DESCRIPTION OF PLATE IV.

Fig. 1. Cephalic end of male worm, Species No. 1 (× 105).
Fig. 2. Genital orifice of female worm, Species No. 1 (× 130).
Fig. 3. Integument of female worm, Species No. 1 (× 190).
Fig. 4. Natural size reproduction of adult worms of Species No. 1. The worm marked *a* is a female, the others are males.
Fig. 5. Bursa of male, Species No. 1 (× 225).
Fig. 6. Adult female worms, Species No. 2 (× 9).
Fig. 7. Portions of female worms, Species No. 2 (× 57).
Fig. 8. Bursa of male worm, Species No. 2 (× 340).

THE STRUCTURE AND ORIGIN OF CAVERNOUS ANGIOMATA IN THE LIVERS OF OXEN.

By STEWART STOCKMAN, Professor of Pathology, Dick Veterinary College, Edinburgh.

CAVERNOUS angioma is rarely seen in the livers of animals other than the ox. It is stated in some text-books of human pathology that the lesion is commonly found in the dog and cat; my *post-mortem* experience is against this. In the livers of oxen it is nearly always—I think I may say always—associated with that form of cirrhosis caused by the *Distoma Hepaticum.*

During the past few years at the Edinburgh Abattoir I have examined about 100 livers from oxen harbouring the *Distoma Hepaticum.* These livers were always enlarged and cirrhotic. It was exceptional to find the cirrhosis unaccompanied by angioma. I may say, then, that the latter lesion is as frequent as distomatosis itself.

In hepatic distomatosis of the ox the distribution of the new tissue is always more or less irregular, although fibrous patches may be found in every part of the organ. In certain cases the enlargement is confined mainly to the upper two-thirds, in others the liver is enlarged throughout its whole extent. The angiomata are seen under the capsule and in the liver substance, usually apart from the fibrous tissue. On the surface they appear as unraised areas of a slate

Fig. 1

Fig. 2

Fig. 3

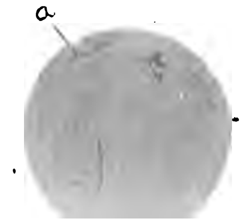

Fig. 4

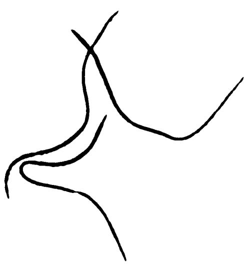

Fig. 6

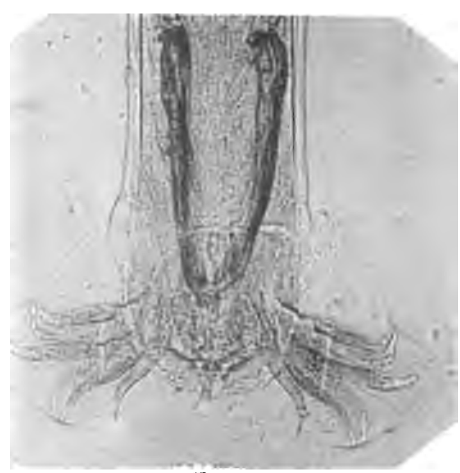

Fig. 5

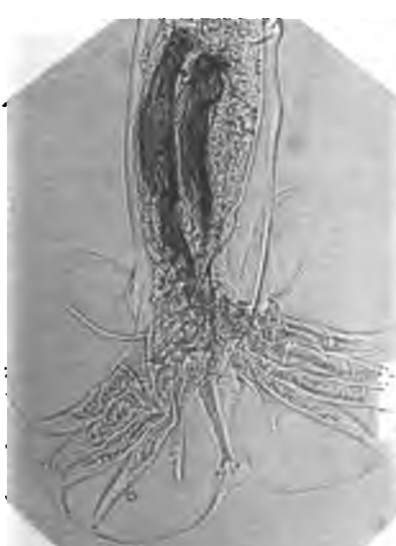

Fig. 8

Fig. 7

blue colour; in the substance of the organ they have colour of venous blood. Their size varies from a pea to that of the fist, but the pea-sized ones are by far the most frequent. There may be only one or two present, or there may be dozens. They are least numerous in the markedly cirrhotic portions, but one sometimes sees there evidence of their former existence. The advancing fibrous tissue seems to crush them out.

The cause of the lesion I believe to be the new fibrous tissue, which, by compressing and obliterating the vessels in one region, raises the blood pressure in the non-cirrhotic parts. As a result of the increased pressure the capillaries become dilated. They press on the intervening liver cells, causing them to undergo atrophy and to disappear. Some of the cells seem to be washed away in the blood stream. By removal of the liver cells several capillaries come into contact by their walls. The central ones give way and vascular cavities are formed. The formation of these cavities relieves the pressure for the time being.

The microscopical examination of serial sections bears out this view. If a section be made through the angioma near its centre, one sees a number of blood-containing spaces. The spaces are not separated from each other by fibrous septa, as usually described, but by liver cells. In many cases a slightly thickened capillary wall and a single row of liver cells separate one space from another. The intervening liver cells may be so compressed that they at first sight resemble a fibrous strand under a low power, but their real character can easily be made out by using a higher magnification. The circulating blood does not come into direct contact with the liver cells; the latter are separated from it by the capillary walls at their margins. The walls can be distinctly seen. They do not usually give way until the cells have been removed. In a very few cases a vascular space surrounded by a distinct fibrous wall is found. It is usually isolated and unpartitioned. If through the angioma sections be made in series until healthy-looking liver is reached, one sees that the cavities become smaller and smaller. The liver tissue becomes more compact until it takes the appearance of a small nutmeg area. These local nutmeg areas can be seen in different parts of the organ. They represent the first stage in the formation of the angioma.

The angioma is usually described as a neoplasm composed of blood vessels. The above described formations, however, are not neoplasms, as no new vessels are formed; indeed, the reverse is the case. They are not even tumours, since they do not project. They are simply spaces hollowed out in the liver in the manner above described.

The ox is not the only animal in whose liver the fluke causes cirrhosis. The sheep is often the host of these parasites, and the horse's liver is more often cirrhotic from this cause than one admits. I have had in one year as many as three horses' livers cirrhotic from the presence of the fluke sent to me.[1]

I have never seen angioma accompanying cirrhosis in the sheep or horse. In these animals, however, the new tissue is more evenly

[1] In these livers the parasites were not numerous. At first I failed to find a single one, but after slicing the organs and leaving them over night, a few crawled out to the cut surfaces.

distributed through the liver than in the ox, and I think that is why the blood vessel lesion is absent. In the horse and sheep the vessels are certainly compressed and obliterated, but the compression takes place all over the organ.

DESCRIPTION OF PLATE V.

Fig. 1. Section near the centre of a cavernous angioma of the liver of an ox.

Fig. 2. Section through the same angioma farther from the centre.

Fig. 3. Section through the outer part of the same angioma.

PRELIMINARY NOTE ON THE SERO-DIAGNOSIS OF GLANDERS.

By J. M'FADYEAN, Royal Veterinary College, London.

A REMARKABLE example of the useful application to every-day medical practice of what was at first regarded as a discovery interesting only to bacteriologists, is afforded by the so-called sero-diagnosis of typhoid fever, recently introduced by Professor Widal of Paris.

It has for some years been known that the blood-serum of animals experimentally rendered immune against a particular disease exerts a peculiar action on the specific bacteria of that disease, the most manifest effect of this action being a grouping of the bacteria into relatively coarse clumps when they are freely suspended in liquid. Widal discovered that this action is not confined to animals experimentally made immune, or hyper-vaccinated, but is also possessed by the blood of human beings suffering from typhoid fever, and he showed that it might be utilised in the diagnosis of that disease. Grünbaum, Durham and Grüber, and Delépine and Sidebotham have published observations that are confirmatory of Widal's discovery.[1]

The demonstration of this remarkable property of the blood of typhoid patients immediately suggests that in other bacterial diseases of man and animals the blood may exert a similar effect on the specific microbes, and the purpose of the present note is to put on record some observations which appear to show that the method of sero-diagnosis is applicable to the case of glanders.

On the 19th December I collected a few ounces of blood from a horse affected with chronic glanders. The clinical history of the case indicated that the disease had been in existence for several months (nasal discharge, loss of condition, etc.), and the diagnosis of glanders, made by my colleague Professor Hobday, was verified by a decided reaction to mallein two days before the horse was killed, and by the discovery of typical glanders lesions at the *post-mortem* examination.

The blood serum of this horse when diluted with nine times its volume of sterile bouillon and mixed with an equal volume of bouillon holding in suspension a rich culture of glanders bacilli (three days' culture on agar at 37° C.) was found to produce marked "clumping" of the

[1] *See* the Lancet for 14th November, and 5th, 12th, and 17th December of this year.

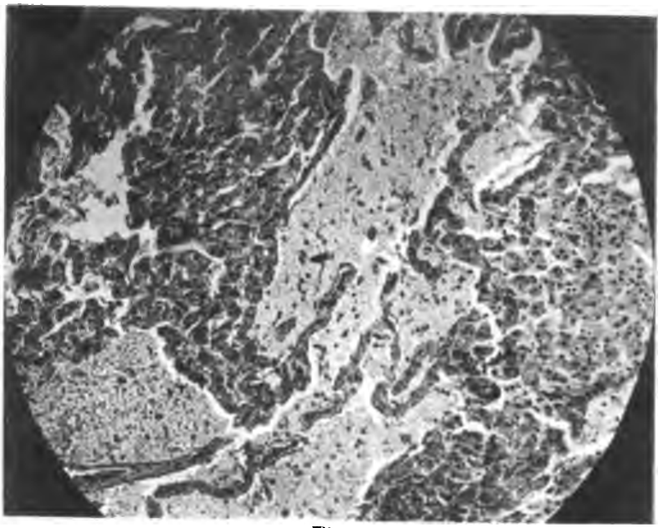

Fig. 1

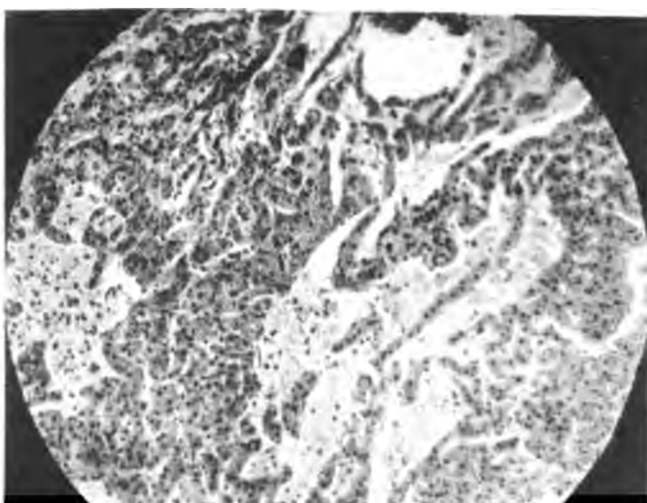

Fig. 2

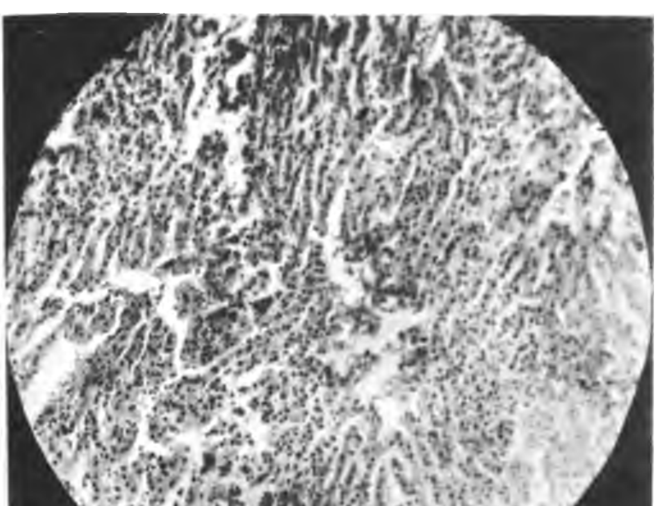

Fig. 3

bacilli. The reaction was quite distinct after an hour, and at the end of two hours almost the whole of the bacilli had become motionless and collected into large irregular clumps.

Control observations were made at the same time with blood-serum (diluted to the same extent) from two horses not suspected of being glandered, and since tested by mallein with a negative result. The serum from one of these animals produced no appreciable clumping even after several hours; in the other case a tendency to "clumping" was observable in some of the preparations, but it was later in setting in, and never anything like so complete as in the preparations from the glandered horse.

The observations here referred to were made on "hanging drop" preparations viewed under the microscope.

Should further observations confirm these results, a valuable addition to our methods of diagnosing glanders will have been made. Considering the perfect reliability of the mallein test and the simplicity of its application, it cannot be expected that the method of sero-diagnosis will displace it, for Widal's method must always remain a laboratory test. But the latter has the advantage of being serviceable for diagnosis on the dead subject, and it may be employed as a prompt confirmatory test in those occasional cases in which no glanders lesions, or only lesions of a doubtful character, are discovered at the autopsy of horses that have reacted to mallein.

EDITORIAL ARTICLES.

CATTLE DISEASE IN JAMAICA.

In the month of August last Professor Williams of the New Veterinary College, Edinburgh, paid a visit to Jamaica in order to determine the nature of the disease or diseases responsible for the unwonted mortality among the cattle there. The results of his investigations are given in a Report which is published as a supplement to the *Jamaica Gazette*, and which we have reprinted at a later part of this number.

Before proceeding to notice one or two points in Professor Williams' Report, it may be observed that this is the second inquiry which has recently been made regarding cattle disease in Jamaica. The first was conducted by a Commission which was appointed in the latter part of 1894, and presented its Report in December of that year.[1] The members of the Commission visited various places on the island from which complaints of heavy losses among cattle had been received, and they there took the evidence of farmers and others, and also personally inspected diseased animals before and after death.

The Commissioners reported that they had obtained evidence of

[1] Supplement to the Jamaica Gazette, 17th January 1895.

an abnormal mortality among the cattle in about half-a-dozen parishes, and that the symptoms of the disease, as noted during personal inspection of the affected herds, and as described by persons having the management of them, were exactly similar in all the districts. These symptoms were, "loss of condition, in some cases rapid, and in others more protracted, harsh staring coat, scurfy appearance of the neck and flanks, the skin being covered with ticks, large and small, a drawn lank appearance, a high temperature and laboured respiration, denoting fever. In some cases evidence was given of the suffering animal wandering about in a restless condition, coupled with anxiety for water. These symptoms continue till the animal becomes so debilitated as to be unable to rise and move about, after which death rapidly ensues." The duration of the attack varied from three days to as many weeks, and in those that recovered convalescence was very slow.

The symptoms and *post-mortem* appearances led the Commissioners to conclude that the cattle were suffering from parasitic disease, caused by the presence in the intestines and lungs of nematodes belonging to the species strongylus micrurus, strongylus contortus, and strongylus rufescens. They also had evidence to show that for some years previously anthrax had been the cause of enormous losses among cattle in several parts of the island. There had also been a very considerable mortality among calves, horses, and sheep, from diseases of an obscure kind.

The measures recommended by this Commission were, the exercising of more care and attention in examining the herds of cattle, and discovering the very first symptoms of the approaching ailment, the prompt obtainment of professional aid in the treatment of the animals discovered to be affected, complete isolation of any animals so affected, cremation of carcases of diseased animals, removal of the remainder of the herd to fresh pastures, and greater attention to water supply. Finally, the Commissioners strongly recommended the establishment in the island of a scientific institution presided over by a competent bacteriologist, microscopist, and pathologist, who when required would examine specimens with a view to diagnosis, and also manufacture material for vaccinating animals against anthrax.

Professor Williams' investigations appear to have confirmed the results arrived at by the before-mentioned Commission so far as relates to the prevalence of anthrax and parasitic disease of the lungs and stomach, but some of the statements made with regard to the former affection are such as to raise grave doubts in the minds of readers who are conversant with bacteriological methods. For example, Professor Williams reports that he was "able to detect" anthrax bacilli (which apparently means that he identified them under the microscope) in the water of a particular pond, and

in refuse thrown out of an open drain in a yard that he visited. And as if that were not a sufficient bacteriological feat, he states that from the sources mentioned he was able to cultivate these same organisms in "soups and jellies" taken with him from Scotland for the purpose. It would be difficult to say which of these statements is the more remarkable, and it is not easy to take seriously a report containing such vagaries.

If Professor Williams had reported that by inoculating susceptible animals he had been able to prove the presence of anthrax bacilli or their spores in pond water or drain refuse, no one who had not witnessed some error in his experiments would have been justified in casting doubt on his conclusions, but when he resorted to microscopic examination of water and dirt for the detection of anthrax bacilli, and attempted to isolate these bacilli from such materials by "soup" cultivations, he betrayed such a want of acquaintance with the proper methods of bacterial research as to make it impossible to place any reliance on the conclusions at which he arrived. It is not easy to understand why Professor Williams, when he ascertained that cases of anthrax had occurred on particular farms, thought it necessary to search the soil or water for the anthrax germ, for on the strength of his own writings he is credited with the belief that the conversion of harmless saprophytic bacteria into the virulent anthrax bacillus is frequently responsible for outbreaks of splenic apoplexy. Perhaps, however, the phases of this conversion can be followed with the microscope!

The main part of Professor Williams' report is devoted to the subject of Texas fever, which he takes to be the principal cause of the losses among Jamaica cattle at the present time. It cannot be said, however, that on this subject he is more convincing than when dealing with anthrax. In order to enable the reader to judge for himself on that point, it will be necessary to describe briefly what is known regarding the disease which, under the name of Texas fever, has been the cause of serious loss among United States cattle.

Texas fever, according to the published researches of American authorities, chief among whom are Smith and Kilborne,[1] is a disease which is spread by cattle in transit from the Southern to the Northern States. The Southern cattle bearing the infection are as a rule free from any signs of disease. The infection is carried only during the warmer season of the year, and in the depth of winter Southern cattle are harmless. The infection is not communicated directly from Southern to Northern cattle, but the ground over which the former pass becomes infected by them, and in that way the disease is transmitted to Northern susceptible cattle put to graze on contaminated pasture. The disease is artificially transmissible, with undiminished violence, from a diseased to a healthy animal by inoculation with the

[1] "Texas or Southern Cattle Fever." Published by the Bureau of Animal Industry, 1893.

blood of the former, and in natural circumstances this inoculation is effected by ticks. The disease manifests itself in two forms, viz., the mild, usually non-fatal type, and the acute fatal type. The latter is the disease of the hot summer months, and it appears suddenly, and as a rule at the same time in all animals of a herd which have been exposed to the same infection together. The outward symptoms are usually preceded by a rise of temperature, ranging from 105° to 108° F. The pulse and respiration rise with the temperature. "The one sign regarded as peculiar and pathognomonic in this disease is the discharge of urine having the colour of blood." Smith and Kilborne found hæmoglobin present in the urine at the *post-mortem* of thirty-three out of forty-six fatal cases. In the thirteen negative cases the animals had either been killed early in the disease, before the dissolution of the red corpuscles had set in, or they had died or been killed after the acute stage was over. The bowels are generally constipated during the high fever, the appetite is always lost, and rumination is usually suspended after the third or fifth day. The animal rapidly wastes during the period following the fever, and the blood becomes pale and watery. In fatal cases death occurs in from four to fourteen days from the onset of the illness, or it may be delayed beyond that. In summer outbreaks the disease is very fatal, and the whole of the animals attacked may succumb. As regards the lesions present in fatal cases, it is said that "most veterinarians and pathologists are able to recognise Texas fever when an acute case presents itself for *post-mortem* examination. The greatly enlarged spleen, the peculiar coloration of the liver, the thick bile, and especially the hæmoglobinuria, are so obvious that no one trained to a knowledge of the appearance of the healthy organs and excretions in cattle can make a mistake." The disease may also be diagnosed by the presence of double pyriform amœboid parasites in the red blood corpuscles.

The mild type of the disease is generally seen from October to December. Earlier in the season this type is mainly confined to the less susceptible calves, the great majority of the adults being attacked with the acute form. It is non-fatal, and it has neither symptoms nor lesions that are characteristic, but it may be diagnosed by the presence of minute coccus-like parasites in the red blood corpuscles.

Turning now to the Jamaica disease, it will be observed that Professor Williams' report gives in most respects only a meagre account of the course of the illness, the symptoms, the rate of mortality, or the lesions. It does state, however, that, except in one doubtful instance, the symptom which is most characteristic of Texas, viz., hæmoglobinuria, was absent, and it is an equally notable admission that the most constant *post-mortem* lesion of Texas fever—enlargement of the spleen—was never once encountered in the Jamaica disease. The conclusion that the latter was Texas fever appears to rest solely on the observation that the affected cattle had ticks on the skin, and on the alleged

presence in a few cases of peculiar bodies in the blood, although it was not "deemed advisable to enter into the question whether these bodies are really plasmodia of foreign origin, as considered by some, or merely embryonic or degenerative forms, or pathological modifications of the normal red or white cells or blood-plates."

A conclusion which appears to have more justification from the facts stated is that the Jamaica disease is not Texas fever—that is, assuming that the latter disease has been correctly described by those who are conversant with it in the United States. It is true that in what American authors describe as the mild non-fatal type of Texas fever there is neither hæmoglobinuria nor splenic enlargement; but it is scarcely admissible to try to bring the fatal disease among Jamaica cattle into line with the American disease by assuming that the former may retain the virulent clinical characters of the acute type of Texas fever, and at the same time present the *post-mortem* appearances of the mild non-fatal type.

That the Jamaica disease is not Texas fever appears clear enough, but as to what it is the available evidence hardly justifies a guess. It is perhaps worth while pointing out that it has not even been proved that it is a transmissible disease like Texas fever, and, considering the ease and certainty with which this might have been determined by experimental inoculation, the omission of any reference to the point in Professor Williams' report is remarkable. We offer this as a hint to those veterinary surgeons resident in Jamaica who have opportunities to further investigate the disease. It certainly is a point that ought to be settled before the Jamaica authorities give effect to Professor Williams' recommendation to import the starling and the song-thrush, or to breed long-legged varieties of the common fowl to pick the ticks off the cattle.

CATTLE PLAGUE IN AFRICA.

THE spread of rinderpest in Africa has recently been furnishing a text to those all-wise people who instruct their fellow-creatures through the medium of letters to the newspapers. Governments, we are told, were warned that the disease had obtained a footing in Northern Africa, and that, unless prompt measures were taken to arrest its spread, it would invade the entire continent from North to South. The prophecy appears to be in rapid process of fulfilment, and those who made it are as ready to take credit to themselves, and to cast reproaches on others, as if they had disclosed the methods by which the disease might have been stamped out.

As a matter of fact, it needed no prophetic gift to foresee the rapid extension of the plague in Africa as soon as it had obtained a firm footing there. The history of outbreaks in our own country and in other European States contains abundant evidence of the difficulty of

arresting the spread of cattle plague, even in civilised countries, where the circumstances are a hundredfold more favourable for the enforcement of preventative measures than in Africa. Nor are there any secrets regarding the only reliable means of keeping any given territory free from the disease. Every European State has long ago recognised that freedom from cattle plague cannot be insured by any less rigid measure than the absolute interdiction of cattle traffic with countries in which the disease is known to exist. And to prevent the spread of cattle plague between countries with a common land frontier even such a measure would not give complete security, for the virus is readily carried by intermediary bearers, such as hides, forage, human beings, etc. But, so far as regards the means for dealing with epizootic disease is concerned, Africa may be regarded not as a group of separate States, but as one country, and nothing less drastic than the measures which served to stamp cattle plague out of Great Britain will cleanse Africa of that disease. Since arrest of cattle traffic and wholesale slaughter of diseased and suspected animals are probably impossible throughout the greater part of Africa, that is tantamount to saying that in the regions of Africa already invaded rinderpest will for many years to come remain as an enzootic affection, as it is in many parts of the Asiatic continent at the present time. This is no doubt a gloomy outlook, but there is a ray of consolation in the knowledge that in course of time the excessive virulence which the disease always displays on a first invasion is likely to materially diminish.

It is not unlikely that this forecast of the future history of cattle plague in Africa will lead ill-informed people to exclaim, "And is this what British veterinary science amounts to at the end of the nineteenth century?" A wail to this effect has indeed already been uttered in some of the lay papers *a propos* of the announcement that the Government of Cape Colony has invited Koch to South Africa to investigate cattle plague. The advent of such a distinguished bacteriologist in the territory ravaged by the disease is evidently by some people supposed to be full of promise for the introduction of what are called "rational" measures of suppression. The germ which is the cause of the disease is soon to be discovered, and that is to be followed by the introduction of a system of vaccination, to displace the barbarous "stamping-out" method which hitherto has been the only serviceable weapon at the command of British veterinary surgeons.

We are sorry that we cannot share these expectations. Professor Koch may discover the germ of cattle plague, and we sincerely hope he will. It may confidently be said that if he fails no other person need hope to succeed by the methods of research at present known to bacteriologists. The discovery of the germ of cattle plague would be another triumph for bacteriology, and it could hardly fail to add to

the sum of knowledge that is practically useful, but we venture to express a doubt as to whether the introduction of a system of vaccinating against cattle plague is likely to be among such additions. No one who has given much thought to the subject can for a moment believe that, even if we were in possession of a means of vaccinating animals against cattle plague with as much certainty as vaccination properly so called protects human beings against small-pox, the method could be successfully employed in dealing with the disease in savage countries. And even in settled and civilised countries it does not follow that because we are acquainted with a means of protective inoculation we ought to apply it in preference to any other method of dealing with the disease. It is too often forgotten that our choice of weapons in these cases is determined by questions of cost, and that the cheapest method is the most rational, provided it is efficacious.

Lastly, it may be mentioned that Professor Koch has left behind him in his native country a considerable number of human and animal plagues with undiscovered germs, and that German flocks and herds are still decimated by pleuro-pneumonia and foot-and-mouth disease, although Great Britain has set the nations the example in stamping these diseases out. We mention this, not as a reproach to Professor Koch or the German Agricultural Department, but in defence against the charge, generally made with little knowledge, that "they manage these things better abroad."

Reviews.

Outlines of Veterinary Anatomy. Part I.: The Anterior and Posterior Limbs. By O. Charnock Bradley, M.R.C.V.S., etc. P. 189. London: Baillière, Tindall, & Cox. Price 4s.

It is a difficult matter to decide in one's mind how much or how little is to be expected from a work which, from its title, is understood to merely touch the fringe of a subject, and the reviewer is apt to consider that too little is given in one place and too much in another. It is also, when a technical work is examined, a question as to the class of readers the author has provided for.

We observe in the preface that the author does not claim originality (other than in the treatment of his subject) or completeness, and the work is intended for use with the larger text-books. The object then is to save the student making his own notes as he works through the manuals provided for him, and this labour saving for the student is not to his advantage. Half his battle is won by making his own notes of his reading and work.

The "outlines" treats of veterinary anatomy in the following order:—first the bones, then the joints and ligaments, then the muscles, followed by the arteries, veins, lymphatics, nerves, epidermal appendages, and the foot, in the order named. The comparative anatomy next succeeds. This is for the fore

limb, and the hind limb repeats the order. Turning to the text, we are bound to admit that conciseness is the rule, so much so that in most cases the descriptions are insufficient, and not of such a character as to give the student the knowledge he requires of so important a system as that of the bones. Take the first bone described, the scapula, and note what the author says of the angles: "Anterior or cervical thin; posterior or dorsal tuberous; inferior or humeral expanded and separated by a neck or cervix. Presents: 1. Glenoid cavity for articulation with head of humerus; 2. Coracoid process, situated anteriorly, and divided into a base and summit, or beak curved inwards." This is insufficient, if junior anatomy, as it is termed, is to be made introductory to senior anatomy. But doubtless Chauveau's or Strangeways' work is at hand. Again, on pages 15-25, and elsewhere, the term "interrupted" bone is used; an interrupted joint we know, but not an interrupted bone. Then the carpal and tarsal bones are not irregular bones, but short bones, as are also the sesamoids. The author has correctly classified them in the appendix, but in the descriptions they are wrongly named. The pisiform bone is named trapezium and *vice versa*, and the scaphoid of the tarsus is named the cuneiform magnum. It is scarcely necessary to point out that this nomenclature is inadmissible, because pisiform is the name of the bone, and is not descriptive. If a special name is to be manufactured to suit the peculiarity of shape, size, etc. of every bone occurring in the different animals, then veterinary nomenclature, formidable as it already is, will become appalling. As to the scaphoid it is wrongly named cuneiform magnum; and thus in the pig and dog four cuneiforms are described, manifestly an error from the comparative point of view. The author might have clung to Chauveau and thrown over Strangeways.

On page 31 all movements are assigned to the shoulder joint. Surely this is not correct as applied to the horse; circumduction and rotation are certainly at a minimum, and owing to the insertion of the muscles into the humerus, and these passing in close proximity to the articulation, coupled with the insertion of the pectorals, movements here are mostly limited to flexion and extension.

In the part treating of the muscles we observe that the synonyms are pretty fully given, but if it were necessary to give synonyms in a book on "outlines," which we question, why limit them to those used by Chaveau, and included as taken from Girard and Leyh? Moreover the "teres externus" is not the "teres minor"; the teres externus is the deltoid, the teres minor is the so-called postea spinatus minor. Why is biceps a misnomer on page 46? It is no misnomer; it is the name of the muscle. That it has not two heads of origin we know, at least in the horse, but the same muscle in some other animals has two heads, and from this the muscle was named, and as a name it does very well. On pages 53, 56 and 57 the words "check ligament" occur in connection with three different muscles; the author might have indicated which is *the* check ligament.

In almost every instance the author has closely followed Chauveau in his descriptions of the muscles, but, of course, much of the verbiage of the latter has been sacrificed, though in some instances, as in the description of the scapulo-humeralis gracilis muscle, they tally in a remarkable manner, allowing for the different characters of the books. As to the vessels, Chauveau and Strangeways have been followed in the descriptions; but as to the nerves, we notice the types have not been so closely adhered to. Two white lines (pages 77 and 80) are described in the foot, one just below the coronary cushion, the other in the usual place. "Production of the hoof" occupies less than four lines and a half.

The comparative anatomy (that of animals other than the horse) closely follows that given by Chauveau, but considerably condensed.

As to the posterior limb, the general remarks upon the fore limb apply here also, but why the author preferred Strangeways' description of the ligaments of the pelvis to the more rational one of Chauveau is more than we can understand. Nor can we see why the sacro-iliac joint is termed an amphiarthrosis, although provided with a synovial membrane. We thought the latter always conferred the dignity of true joint upon an articulation. The crureus muscle is described! The soleus is called plantaris, though if the plantaris is present in the horse it is that portion of the flexor pedis perforatus arising from the supra condyloid fossa and inserted into calcaneum, the remainder being the flexor brevis digitorum.

But we have given sufficient to show the scope of the work, which generally is an abridgment of Chauveau or Strangeways, or both, though here and there, as mentioned above, there are mistakes that should have been rectified by an up-to-date anatomist. A. E. M.

A Text-Book of Bacteriology and Infective Diseases. By EDGAR M. CROOKSHANK, M.B., Professor of Comparative Pathology and Bacteriology, and Fellow of King's College, London. Fourth Edition. London: H. K. Lewis, 1896.

THE fourth edition of this well-known text-book is practically a new work. The text has been largely re-constructed and re-written, and the addition of new matter has made it nearly double the size of its predecessor published in 1890. A large number of illustrations have been added, and with scarcely an exception these are of a very high quality.

The growth of the present edition is largely due to the greater space devoted to morbid anatomy and prophylaxis. As the title indicates, the work is not simply a text-book of bacteriology, for it deals with all the more important contagious and infectious diseases of man and the domesticated animals, and, needless to say, a good many of these have as yet no definite bacteriology.

The greater attention paid in this edition to morbid anatomy is, we think, an improvement, for the lesions of the bacterial diseases are most naturally described in connection with the life history of the microbes that cause them. It must be admitted, however, that, at least so far as relates to the morbid anatomy of the infectious diseases of the domesticated animals, this is the weakest part of the book.

In speaking of anthrax the author says that he is in a position to give a definite answer to the question whether the disease produced by the bacillus anthracis ever occurs in the horse, and he gravely proceeds to answer this in the affirmative, on the ground of his own examination of the blood of a mare. Here and there in dealing with diseases of the lower animals, there are passages which, like this, are calculated to give a shock to veterinary readers. To take another example, the author seriously raises the question whether swine erysipelas is a distinct disease of the pig, and proposes the conundrum, "How can rouget be distinguished from cases of swine-fever in which there is a rash, paralysis of hind legs, but no ulceration of the intestine?" No doubt there is a great deal of confusion in the older literature of epizootic diseases of the pig, but that confusion no longer exists, and we fancy that any recent veterinary graduate is quite competent to answer these questions.

We have thought it right to point out these defects, which, after all, only slightly mar what is certainly the best book on bacteriology in the English language.

Annual Report of the Proceedings under the Diseases of Animals Act, etc., for the Year 1895. Printed for Her Majesty's Stationery Office, by Eyre & Spottiswoode, London.

THIS is the latest issue of what veterinary surgeons have long been familiar with under the title of the Annual Report of the Veterinary Department of the Board of Agriculture. We trust that in future reports the old name will be restored.

The first part of the Report is occupied by the Chief Veterinary Officer's account of the operations of the Board with regard to the diseases scheduled under the Contagious Diseases of Animals Act for the past year. It is matter for regret that nine months of 1896 had elapsed before the Report appeared. As might have been expected, the place of honour is given to the subject of swine-fever, the lesions of which are illustrated by a series of beautifully executed chromo-lithographic plates. Under the head of pleuro-pneumonia it is stated that only one case of that disease was met with in British cattle in 1895, and in that instance the disease was detected in a cow slaughtered at a butcher's in the east end of London.

In the second part of the Report the Principal of the Animals Division gives an account of the work done by the members of the staff, and statistics regarding cattle importation, the conveyance of animals by sea and land, the operation of the Markets and Fairs Acts, etc.

If there is any class of men who ought to make a point of studying these reports, that class is the veterinary profession. The present issue is published at the modest price of one shilling and threepence, which can hardly be sufficient to pay for the bare cost of production.

The Annual Statistical and General Report of the Army Veterinary Department, for the Year ending 31st March, 1896.

IN this Report the Director-General gives an account of the health of British Army horses which, like its predecessors, reflects credit on the officers of the Army Veterinary Department.

There were 13,446 troop-horses, 147 mules, and 1844 chargers on the 31st March, 1896, as compared with 13,192 troop-horses, 178 mules, and 1915 chargers in the previous year. The amount of inefficiency from diseases and injuries was 7·34 per cent. less than last year, being 60·01 as compared with 67·35. The number of deaths from all causes was 20 less than last year, being 296, or 2·22 per cent. of the average strength.

The total number of admissions to treatment was (exclusive of 268 remaining on 31st March, 1895) 7795, or 60·01 per cent. of the average strength, being 974 less than in the previous year. The largest number of admissions, as in previous years, was in the Army Service Corps (this is accounted for by having the Young Horse Depôts of the Army Remount Establishment attached), being 94·77 per cent. The admissions were fewest in December, February, and January, and most numerous in August, July, May, and June. This was owing to extra duty imposed on the horses by summer drills, etc.

The average number of days each horse remained under treatment was the same as in the four previous years, viz., twenty-one days. The inefficiency from the number of days absence from duty of each horse in average strength was thirteen days. This is one day less than the previous year.

The largest number of admissions were, as usual, from surgical diseases and injuries, being, in the aggregate, 5367. Of these, 14 died, and 95 were destroyed. There is a decrease of 123 in the admissions from diseases of the chest and air passages, as compared with last year, but an increase in the

admissions for influenza and epizöotic fever, 208 cases being admitted, as against 43 in 1894. The admissions for adenitis (strangles) are 67 less than the previous year, being 258, as compared with 325. No cases of glanders or farcy occurred during the year, and the last case among army horses was in October 1888, at Hounslow.

The number of persons for which lymph was cultivated in the Army Vaccine Institute during the year was 44,295, and, with the balance remaining from last year, amounts to 45,295; of this, lymph for the vaccination of 43,459 persons was issued, leaving a balance on hand of 1836.

The number of calves vaccinated during the year was sixteen, giving an average of 2830 persons to each calf. The greatest amount of lymph obtained from one calf was sufficient for 3906 persons, and the smallest amount obtained was for 1021 persons. The average daily issue of lymph was for 118 persons. During the year 1837 boxes, 3567 tablets, and 2 tubes were issued. The total amount of expenses for the year, including cost of calves, instruments, etc., was only £75 7s. 0½. Since the opening of the Institute on the 21st January 1889, to the 31st March 1896, lymph has been prepared for 260,596 persons.

In the Report great credit is given to Veterinary-Major Seaward Longhurst and Veterinary-Captain, E. R. C. Butler for so ably carrying on their duties as Instructors at the Army Veterinary School, and for their excellent management of the Vaccine Institute.

CLINICAL ARTICLES.

THE TREATMENT OF TETANUS IN THE HORSE BY TETANUS ANTITOXIN.[1]

By Professor DIECKERHOFF and Dr PETER.

IN a former article appearing in the *Berliner Thierärztliche Wochenschrift* (No. 47, page 555) we called attention to the great therapeutic importance of Behring's tetanus antitoxin in the treatment of tetanus of the horse. It only remains to report that the course of the disease in the cases there described proved exactly as had been predicted. Since then three other cases of tetanus in the horse have been treated with Behring's tetanus antitoxin in the Medical Clinique of the Berlin Veterinary College, and the result in these cases will be briefly recorded in this article. In the first place, however, it will be well to refer again to the already published cases.

CASE I.—Black mare, about ten years old, which was treated with antitoxin on the 10th November, had so far improved on the 16th November that a favourable course of the disease, in a relatively short time, could be foreseen. As a matter of fact, the tonic muscular contractions gradually declined, so that on the 4th December the last traces of tetanus were scarcely observable On this day the mare was discharged from the clinique. It is worthy of

[1] Translated from the "Berliner Thierärztliche Wochenschrift," 10th December, 1896.

notice that some days after intravenous injection of the dissolved antitoxin a diuretic effect of the agent was observed. The mare frequently placed herself in a position to urinate, but passed only a small quantity of urine of a clear watery character. Owing to the nervous behaviour of the animal while suffering from the tetanus, it was impossible to carry out an accurate examination of the urine.

The observation showed, however, beyond any doubt that the antitoxin exercises a diuretic effect, but, on the other hand, it was not observed by us that it had any other action. Up to the 4th December the horse was daily submitted to an accurate examination in the clinique, and during the whole time the pulse was normal in frequence, the rectal temperature was normal, and the breathing quiet.

CASE II.—A well-bred Hungarian chestnut mare, which had been docked three weeks previously. The subsequent examination did not reveal the existence of any other wound. The report was that the animal had been attacked on the 21st November with symptoms of slight stiffness of the body, especially noticeable in the way in which the head was held. It was brought to the clinique on the 22nd November at 11 A.M., and the examination then showed that it was suffering from well-marked trismus, with stiffness of the whole back and continual twitching movements of the tail. The animal displayed great timidity, and tried to avoid any attempts to touch it. The head was held in a stiff position owing to strong contraction of the cervical muscles, and it could not be bent either to the right side or the left.

The trismus was so great that the incisor teeth could be separated only about 1 cm. Respirations 36, pulse 40, temperature 38·40°. On the evening of the 22nd November the mare received by intravenous injection a curative dose of Behring's antitoxin in watery solution. She was placed in a large loose-box in which she could move freely about. The amputation wound of the tail was treated with caustic. On the 23rd November symptoms of tetanus were very well marked, abundant saliva was discharged from the mouth, and the horse could take only a little food owing to the strong trismus. Respirations 20, pulse 34, temperature 38·1°. On the 24th November the mare moved her legs more freely, and was also less timid than on the date of admission, while the twitching of the tail was less marked.

During the following days the mare still moved with the head held in a stiff position, but did not display the timidity and excitement characteristic of a severe case of tetanus. She was also able to masticate food. On the forenoon of the 26th November she lay down quietly in the loose-box, but owing to the stiffness of the muscles of the neck, and the consequent inability to elevate the head, she could not get up. However, she quickly sprang to her feet when the head was supported by the attendant, and was not in any way excited in consequence of having been down. Up to the 30th November the improvement was rapid; the trismus had so far abated that the mare ate oats, carrots, and hay as well as a healthy horse. She was also able to bend the neck in feeding, although in moving in the loose-box the head was still kept stretched out. From this date onwards the condition of the animal gradually improved. On the 3rd December the mare, after she had lain down, was able to get up without assistance,

and by the 6th December the symptoms of tetanus had so far receded that the only trace of them observable was a stiffness in the way in which the head was held. There can be no doubt that in a short time the mare will have made a complete recovery.

CASE III.—On the 25th November, a black, heavy, draught gelding, twelve years old, was brought to the clinique with a report that in consequence of a prick of the foot the animal had been attacked with tetanus eight days previously, and had been treated for the same by a private veterinary surgeon. Owing to the non-delivery of some antitoxin previously ordered, nothing could then be done except put the animal in a loose-box and give it the necessary attention. On the day of admission the respirations were 12, the pulse 40, and the temperature 37·7°. The horse could eat pretty well, so that judging by the symptoms the disease appeared likely to run a mild course, but, as is often observed in cases of tetanus, a notable increase of the trismus set in on the eighth day of the disease; on this day the horse was no longer able to take food. With the greatest force the incisor teeth could not be separated for more than 2 cm. At 11 A.M. the horse received, by intravenous injection, a dose of Behring's antitoxin, but that agent was no longer capable of averting the consequences of the extreme trismus. The horse was unable to take any food at all, and owing to the stiffness of the tongue the saliva could neither be swallowed nor expelled from the mouth. Pulse 45, respirations 70, temperature 38·8°. The conjunctival mucous membrane was of a venous tinge. As it was now to be feared that the animal might lie down it was placed in slings. However, it was attacked with putrid broncho-pneumonia in consequence of the entrance of saliva into the air passages, and it died on the forenoon of the 30th November. The *post-mortem* examination, which was carried out in the Pathological Institute of the College, confirmed the diagnosis made in the clinique.

CASE IV.—A brown, heavy, cart gelding, fifteen years old, had been pricked in the frog of the off fore foot by a knitting needle; this had been removed by a veterinary surgeon on the 26th November, and according to the report the first symptoms had set in on the 30th November. The horse was brought to the clinique on the forenoon of the 1st December, and it was then manifest that the disease was far advanced. Respirations 18, pulse 38, temperature 38°. The whole four limbs were stiffened when the animal moved, the hind feet could scarcely be raised so high as to permit of the removal of the shoes, the tail was slightly elevated and carried towards the right. Marked trismus was present; the upper and lower incisors could scarcely be separated to the distance of 1 cm. There was a great accumulation of saliva in the mouth. On the 1st December, two hours after admission to the clinique, a curative dose of antitoxin in watery solution was injected into the veins. No abatement of the trismus occurred, but on the 2nd December the horse moved its legs very freely. It could also lie down and get up without assistance, but there was no diminution of the stiffness of the muscles of the head, and in spite of the daily irrigation of the mouth with water the consequences of the inability to swallow the saliva could not be prevented. The trismus did not in the least degree abate, and on the 4th December gangrene of the lung developed, as

was evidenced by the stinking odour of the expired air and of the saliva removed by irrigation. The horse died from broncho-pneumonia on the forenoon of the 5th December.

Having described the course of the four cases treated in the clinique with Behring's antitoxin, we confine ourselves here to the remark that this agent in the treatment of the horse does all that Geheimrath Behring has claimed for it.

To everyone who has treated a large number of cases of this disease in the horse it will be apparent that after the early administration of the antitoxin the further development of the disease is retarded, and that thereafter the tonic contractions of the skeletal muscles gradually abate. The horses recover within three weeks, whereas, as is well known, the course of the disease in non-fatal cases in the horse extends over from five to six weeks. It will also be evident that Case II., and also the horse first treated, would have died without the administration of antitoxin.

It will be seen, however, from Cases III. and IV., that when trismus is already strongly developed the administration of the antitoxin is no longer capable of averting the dangerous and invariably fatal complication of gangrenous pneumonia. It is therefore advisable, as Behring has pointed out, to employ the agent as soon as possible after the tetanus has been recognised.

SOME CLINICAL CANINE NOTES.

By F. HOBDAY, M.R.C.V.S., Royal Veterinary College, London.

ENLARGED PROSTATE GLAND TREATED BY CASTRATION.

CASE I.—7th August. The patient, a pampered toy black-and-tan terrier, said by the owner to be about four years old, was brought to the clinique suffering from strangury; the urine was very scanty in amount and only passed with difficulty. An unsuccessful attempt was made to pass the catheter; examination per rectum revealed the prostate gland to be about the size of a large marble and very hard; no pain was expressed on pressure. Castration was advised and performed under chloroform. Antiseptic treatment was followed out until the wounds had healed. On the 13th urination was free and regular, and the catheter could be passed without any difficulty; examination per rectum revealed the prostates to be decidedly less. On the 20th the dog appeared to be all right, and the prostates had resumed their normal size. Since then there has been no further trouble.

CASE II.—3rd December. Was a collie, about nine years old, brought to the clinique suffering from enlarged prostate. The symptoms presented were those of a peculiar gait of the hind legs, inability to walk more than about 10 yards without resting, difficulty in rising after sitting down, and pain when pressure was applied over the region of the loins and flank. This latter was probably due to over-distension of the bladder, as when urination was attempted a certain amount of difficulty was evinced at the commencement, this being followed by the passage of an abnormally large quantity. Examination per rectum

revealed an enlarged prostate gland; castration was recommended and performed under chloroform. Two days later there was a decided improvement in the gait, and at the present time (16th December) the patient is so far recovered as to be able to walk and even run without evincing any pain, to get up without difficulty, and to pass urine freely. No pain is evinced on pressure to the loins or flank, and the prostate is perceptibly diminished in size.

TWO OBSCURE CASES OF FRACTURE DEMONSTRATED BY RÖNTGEN'S RAYS.

CASE I.—The patient was an aged collie dog suffering from intense pain and lameness of the left fore leg. The history as related by the owner was that the animal had jumped some high palings about three weeks previously, and injured itself when alighting on the ground; ever since then the dog had hopped about on three legs. Treatment had been applied, but without beneficial result. When brought to the clinique there was a good deal of swelling, heat, and pain in the region of the carpus, largely due to some irritant liniment which had been applied; in the course of ten days this was got rid of, but the lameness still persisted as much as ever. A most careful examination revealed no crepitus or displacement, but pain was expressed when the carpus was bent. Thinking that there might possibly be a fracture, the carpal and metacarpal regions were skiagraphed; an exposure of three minutes was given, the result being to show distinctly a fracture of the third metacarpal in its upper part, about a quarter of an inch from the carpus. Even after thus localising the spot exactly, it was impossible from external manipulation to detect crepitus or displacement. Splints having been applied and the animal kept at rest for about a month, a good recovery resulted. The leg was again placed under Röntgen's rays, the skiagram showing the two ends to be in complete apposition, but no callus was perceptible. In neither case was an anæsthetic needed, as the dog lay perfectly still.

CASE II. (8th August) was a fat, wire-haired terrier pup, ten weeks old, suffering from a fractured femur. On account of the fat condition of the animal and the length of hair, there was a difficulty in localising the seat of fracture. Anæsthesia was produced by chloroform, and three skiagrams were obtained, two exposures of one-and-a-half minutes each and one of two-and-a-half minutes being given. Two of the results were successful, and the site of fracture clearly demonstrated. A plaster was applied, and the case progressed favourably.

BULLET IN THE EYEBALL OF A CAT.

On the 22nd of November, whilst making a *post-mortem* examination (in conjunction with Mr Towne, M.R.C.V.S.) on the body of a cat which had been shot, we removed the left eyeball. The eyeball itself was atrophied, the cornea being present, and no wound of any kind to be seen. Upon cutting it vertically we found that the lens had escaped, and that in the back portion, on the retina, and surrounded by a small sac of thickened tissue, there was an ordinary air-gun bullet in an almost perfect condition, with the pointed end turned downwards and

inwards. Mr Towne had first been called in to attend the animal for a burst eyeball on the 24th of August, and the protruding portion had then been excised, and antiseptic lotion applied, with the result that there was only a slight discharge present early in October; towards the end of that month this ceased completely, but, of course, the eyeball had become atrophied, and the cat was blind. On the 20th of November the animal was again shot, this time fatally, the bullet passing into the thorax and abdomen, injuring the thoracic muscles, diaphragm, liver and, intestines, and becoming lodged under the spine. The bullet lodged in the eyeball was not at all offensive in smell, and had not recently caused the animal to show any visible signs of pain.

THE TREATMENT OF TUMEFIED EAR FLAP OR HAEMATOMA.

This condition, which is also known as "serous cyst, abscess, or blood tumour of the ear," appears to be by no means uncommon in dogs and cats, and is often very troublesome to treat; it consists of an effusion of fluid between the lower layer of skin of the ear and the cartilage. The previous history usually obtainable is that of a contusion or injury to the ear flap; the presence of otorrhœa, with the consequent continual shaking and bruising, is a particularly common cause. The time in which this effusion has been noticed to be forming of sufficient size to attract notice has varied in our patients from three days to three weeks. When examined, the swelling may be tense or somewhat fluctuating, and it is usually very tender. As the lesion is very unsightly, and the animal in a constant state of irritation and pain, it is a matter of necessity that some treatment be speedily adopted in order to afford relief.

Although of common occurrence in canine practice, the subject has not received more than a passing note in our text-books. The usual method of treatment adopted is to lance the under surface of the ear flap, carefully press out the contents, and treat the wound antiseptically; some practitioners afterwards insert a plug of cotton wool or tow in order to keep the edges of the wound apart and prevent too rapid healing, or inject solutions of iodine. A net, cap, or bandage, put on so as to keep the ear fixed to the head, completes the operation.

In the College Free Clinique, during the past three years, we have had ample opportunity on some thirty cases for testing the value of various methods of treatment; the one which I propose to describe below, and which was first brought under my notice by Professor M'Queen, is certainly the most effective; in no case in which our instructions were properly carried out was there failure to effect a cure. The operation is performed as follows:

The ear is carefully washed and dried with antiseptic precautions, the hair being removed from the upper surface and edges; the patient is placed on the operating table, or suitably fixed in some way, and the parts painted with cocaine (chloroform may be used if preferred); a longitudinal incision is then made in the under surface, and every drop of fluid or particle of clot pressed out (this is very important). The edges and interior of the wound should then be carefully dried with antiseptic wadding, and aseptic sutures passed at

intervals of about one-third of an inch right through the skin and cartilage, the knots of the sutures being made on the upper (hairy) side of the ear flap. The object of this is to produce a firm pressure on the internal surfaces, and also to bring the edges of the wound into contact with one another. This having been completed, and the parts again carefully dried, the whole ear is placed in a pad of antiseptic wadding and bandaged firmly to the head; a cap or net placed over this is of advantage if the animal attempts to remove it. After treatment consists in simply examining the wound once or twice daily, pressing out any fluid which may be present, and carefully drying and bandaging with dry antiseptic wadding. We found this to be a much better plan in the majority of cases than the application of antiseptic lotions or dry powders, although we occasionally resorted to these.

The average time before the bandage could be left off was ten days; in some cases all was well within a week, and in others the wound needed attention for a fortnight or three weeks. As regards the sequelæ, we only got three cases in which the ears were so thickened or bent as to cause any visible deformity, and in each of these the patient was a very troublesome one, or the owner did not follow out our instructions; excessive granulations and re-appearance of the fluid in any quantity were rarities.

I have tried a modification of this plan by suturing the two cut edges together, not passing the sutures right through the cartilage, but the results were not so successful; besides the loss of pressure there is the presence of the catgut or silk suture, which acts as an irritant on the internal surface.

CLINICAL NOTES ON RADIAL PARALYSIS.

By ARTHUR H. BERRY, M.R.C.V.S., Hospital Surgeon, Royal Veterinary College, London.

A GREY gelding, aged about eight years, was admitted into the College Infirmary, 29th August 1896, dead lame on the off fore limb. The only history previous to the sudden lameness was, that while on a journey the animal trod upon a stone with the off fore leg, stumbled, went lame for a few steps, and shortly afterwards, while on the same journey, fell suddenly dead lame, being unable to proceed any farther. He was removed from the shafts, and taken to a stable near at hand. Professional advice was called for, and the result of the examination was given as suspected fracture in connection with the shoulder.

The animal arrived at the College Infirmary in a float, twenty-four hours after the accident occurred. I assisted in his removal from the float, and, with the knowledge that it was a case of suspected fracture of the shoulder, I commenced my examination, but with a negative result. It was not until after examination and manipulation of the affected limb (off fore), and while taking my second survey of the whole limb from the animal's side, that the position of the limb struck me as typical of an illustration I had seen of radial paralysis.

While viewing the limb in profile, from the shoulder downwards, the shoulder, and more especially the elbow, appeared dropped, the elbow

being considerably below the level of the sound limb; for this reason the condltion has been termed "*dropped elbow.*" From the elbow-joint to the knee-joint the limb was advanced, the knee-joint itself being flexed; the cannon bone was directed backwards, the fetlock-joint was flexed, and the whole limb was resting on the anterior surface of the wall of the hoof, the solar surface of the affected foot being in full view, at times perhaps only resting on the toe of the foot, though the predominating position was the former.

To endeavour to make this description of the limb clearer, which is essential, inasmuch as it is the typical position of a limb affected by paralysis of the radial nerve, I had the affected limb photographed

the day after admission, and the photograph is reproduced in the accompanying figure.

The animal evinced no pain whatever on manipulation of any part of the limb, and to see him strike and paw with his affected leg at times (he being of rather an excitable nature) one would have thought that there was nothing whatever the matter with him. The whole limb could be manipulated with ease, joints rotated in any direction with the exception of the knee joint, which could not be straightened, and the leg as a whole could not be placed in the vertical position.

By great pressure on the anterior surface of the knee joint, I with much difficulty managed to straighten the leg, but immediately I removed the smallest amount of support the knee at once became flexed, and if it had not been for the previous precaution of having hands ready to prevent his falling, he would have without doubt reached the ground. There was no heat, swelling, pain, or any local indication whatever to lead me to suspect fracture at the end of my examina-

tion. No perspiration present, no rise in temperature, and no acceleration of heart-beats or respirations. The animal did not appear distressed in any way, and would feed freely from anything that was offered him.

Another important symptom noted was the coldness of the affected limb, to which I shall again make reference.

The horse, although dead lame, could lie down and get up at will, which certainly would not have been the case from such dead lameness resulting from fracture of a bone, or from rupture or strain of muscles or tendons sufficient to produce such lameness as was present in the case in question. When moved forward on the level, which was accomplished against his will and with great difficulty, he failed altogether when called upon to place the slightest weight upon the affected limb.

The animal was supported by two men at his head, and the movement on and off the limb to the sound one was very quick, the sound limb when coming in contact with the ground being fully extended to take the whole weight off the fore part of the body. Although the amount of ground covered was not great, and he would seldom move more than one pace at a time, often several minutes elapsed before he would make an attempt for a fresh start, and then at times would give up the attempt after having tried to feel the ground.

The only suitable illustration I can think of to describe the action of the limb when brought in contact with the ground, is one with which all are familiar, and I expect one which all have experienced, viz., that of "sleepy leg," or "pins and needles" in a leg, resulting from keeping the limb too long in one position, or in an abnormal position. On suddenly rising to our feet we experience a peculiar sensation, and, in fact, in some cases it is most difficult to proceed without falling, as we seem to have lost all power and control of that limb for the time being; such appeared to be the sensation experienced by the animal in this case, that of sudden collapse of the limb when called upon to bear a portion of the body weight.

When going down an incline the movement was similar, but more guarded, and naturally very much more sliding and slipping about.

In the backward movement the affected limb was slowly drawn back during the act of retrogression, and he did not care to go more that one step at a time without resting, but occasionally would attempt two or three steps consecutively. When turned round he would move in a circular manner, making a pivot of the sound fore limb (near fore).

I had the animal placed in slings, but he could not be made to stand in them, not even so that I might have them removed. I lowered the slings to the ground, and then he refused to rise; the slings were disjointed, the girth of them remaining beneath him. Shortly afterwards he sprang to his feet, being very careful to avoid any weight being placed on the affected limb, which was kept quite clear of the ground; with difficulty he managed to reach the hay rack and commenced to feed.

I noticed that when he did move of his own accord (in a well-bedded box), although he was longer in making up his mind to start, and seemed to pick his footing better, he accomplished the step with less danger of falling than he showed when assisted at the head.

I tried the slings again about ten at night, three hours after admission, and this time he took to them kindly, and was left in them all that night.

30th August.—Remained in slings, eating well and apparently in no pain. On passing the hand from the forearm downwards, I was struck with the increasing coldness of the limb from above downwards. Placing my hand on the antero-lateral aspect of the elbow joint, the surface temperature appeared quite normal, but about the middle of the forearm a decided alteration was perceptible, and this became more decided every inch or so. The surface temperature of the skin covering the knee joint was very low and that from the cannon bone downwards, and the hoof also felt as cold as the atmospheric temperature. The skin was moderately sensitive to the prick of a needle throughout the extent of the limb, but below the knee sensation, although present, was not well marked.

The treatment ordered was slings, massage three times daily for half an hour each time, laxative diet, and salines.

3rd September.—Previous treatment continued, skin inclined to chafe over point of shoulder, eating well, surface temperature higher than on day of admission, atrophy of caput muscles visible.

5th September.—Impatient for his food, pawing and striking with the affected limb. Removed from slings on account of sore over point of shoulder caused by the slings; bearing a little weight on limb while standing, but still dead lame. Applied lead lotion to sore on shoulder.

8th September.—Replaced in slings. Point of elbow very tender, bruised through lying on it. Atrophy of caput muscles more marked. Temperature 101°.

10th September.—Progression slow but sure. Putting more weight on limb, standing upright at times. Anterior surface of knee colder to the touch. Point of elbow very tender. Gravitating swelling forming on the inner side of forearm, close to the trunk, about the size of a goose's egg.

11th September.—Doing well, bearing more weight on limb, rechafing point of shoulder through pawing with the affected fore foot in the air. Placed large pad of cotton wool between breast-plate and shoulder joint. Massage to be continued. Apply ung. zinci to sore on shoulder. Anterior part of knee and cannon bone still colder than normal.

12th September.—Removed from slings. Placed in a large loose-box well bedded with tan, and then liberally covered with short straw. The act of progression accomplished with more freedom, bearing more weight on limb and for a longer time, but still dead lame. Shoulder sores healing well. Animal eating well.

17th September.—Certainly slow improvement continues; bearing more weight on limb, and at times placing it under the body. Atrophy of caput muscles well marked.

20th September.—Movement much improved, and at present quite satisfactory; standing upright on limb at times; massage continued.

25th September.—Doing well. Appetite good, surface temperature same as that of sound limb, walking without inconvenience, limb moved naturally.

1st October.—Improving gradually, walking almost sound, marked

atrophy of caput muscles, slow exercise half an hour daily. Massage twice daily as before.

20th September.—Discharged for further rest, walking freely and perfectly sound, much to owner's astonishment. Muscles regaining tone, trotting nearly sound, every anticipation of complete soundness.

MEDIAN NEURECTOMY.

By J. TAGG, M.R.C.V.S., Darbhangah, Bengal.

THE operation of median neurectomy is not generally adopted in this country, but from the little experience I gained from three cases, I have come to the conclusion that in cases of tendonitis, enlarged fetlock joints, ringbones, etc., where other treatment has failed, it might be adopted with advantage as a "*dernèir ressort.*"

Mode of Operation.—Patient thrown and chloroformed; when well under the influence of the anæsthetic, turned on to the back, with a well padded sack of straw, shavings, or sawdust on each side. Leg to be operated on taken out of the hobbles, cross hobbles put on, and the leg gently pulled downwards and a trifle backwards by a rope placed around the fetlock.

The nerve can be easily felt behind the ridge formed by the radius, in a straight line forward from the elbow joint. The part is clipped and shaved, and rendered aseptic with solution of hydrarg. perchlor. All instruments should be rendered aseptic. An incision is made through the skin about 3 inches long, then through the aponeurotic portions of the panniculus carnosus and pectoralis tranversus muscles, until the fascia covering the elbow-joint and the deep lying muscles is seen. The nerve can now be felt, also the pulsation of the posterior radial artery lying in apposition to it. A pad of fat is usually seen covering the nerve and artery, and this, with the connective tissue, should be carefully dissected away until the nerve is well into view. A good plan to keep the incision well open is to place a piece of twine through the skin and muscles on each side of the incision, and tie them together in front of the leg. A tenaculum is now passed under the nerve, and a piece of cat-gut is threaded on the tenaculum and drawn under the nerve. About an inch or an inch and a half is excised. The wound is then well cleansed with an aseptic lotion, and the muscle sutured with carbolised catgut, and the skin with metallic wire. An aperture for drainage should be left in the lower part of muscle and skin.

The horse is kept as quiet as possible for six days, after which time light exercise may be given till the wound has healed.

The following is the list of cases operated upon.

CASE I. was an aged gelding, used for polo. I had treated him for sprained tendons and sesamoiditis some three months before. Treatment consisted of firing and blistering. On recovery from the firing he was put to work, and after playing at polo he went very lame, most marked on near fore.

Median neurectomy performed under chloroform; went perfectly sound on near fore after the operation; wound healed in three weeks. Dressing consisted of zinc. chlor. solution, 1-20.

CASE II.—A chestnut Waler gelding, which got torn by a boar while out pig sticking in April. The boar must have passed under the belly of the horse, as he tore the skin through at the back of the sesamoids. He was a wonderful horse after pig, never requiring any urging, apparently in his glory after one, and as cunning as the pig himself.

The owner, an indigo planter, treated the wound himself, and it healed slowly. The horse was found to go very lame after it, and was sent to me for treatment. I fired and blistered the joint, but still he was as lame as ever.

Median neurectomy was performed under chloroform, and he was perfectly sound after the operation. The wound healed in three weeks. Dressing consisted of carbolic solution, 1 in 40.

CASE III.—This was the same subject as in Case I. He went lame on the off fore, owing to the old sprain and enlarged fetlock-joint.

Median neurectomy performed under chloroform. I found this a more difficult case to do, owing to venous hæmorrhage; it was my fault in trying to perform the operation quickly. The more cautiously one cuts through the tranverse muscle the less the hæmorrhage is.

Went perfectly sound after the operation. Wound healed rapidly, and the pony has gone to gentle work.

SUTURE OF THE DIVIDED RECURRENT TO THE VAGUS IN ROARING.

By the same.

HERE on the plains of Bengal, after the insertion of tracheotomy tubes for roaring, the patients did well till the rainy season commenced, after which, in every case that I had, the patient started rubbing the throat, which caused a growth to develop in the trachea, and entailed an operation lower down for fixing in the tube. The question of suturing the divided left recurrent on to the vagus was touched upon at college, and I well recollect the report that Mr Macdonald had performed the operation, but whether successfully or not I had never been able to ascertain. After the failures I had had with the tube, I had reflected greatly on the possibility of success with the other operation. I was determined to try it; and with this object in view I procured a pony, as I did not care to experiment on a client's horse, with the chance of disaster.

Operation.—The pony was thrown, chloroformed, and placed on the right side, the head and neck resting on a stuffed sack of straw. I decided to operate at the lower third of the neck, and directly over the jugular furrow. The part was clipped and shaved, and well washed with carbolic solution, 1-40. I made an incision through the skin and panniculus muscle, exposing the jugular vein. The connective tissue was broken down with the finger, and the carotid artery could be easily felt by its pulsation. The inferior laryngeal nerve could be plainly seen running in the connective tissue on the œsophagus. I now carefully dissected the connective tissue away with

forceps and scalpel, and severed the recurrent about an inch below the point at which I decided to suture it on to the vagus trunk, so as to avoid any stretching of the nerve. The vagus was not yet in view, but on clearing away the connective tissue slightly above the carotid artery, and lightly pulling the last-named down, the vagus, and I suppose the sympathetic, could be plainly seen. I made an aperture longitudinally with the handle of the scalpel, so as to avoid as much as possible any severance of the nerve fibres. I now placed the peripheral end of the recurrent into the aperture mentioned, and slightly sutured it with carbolised catgut. The wound was well cleansed, very little hæmorrhage occurring, and sutured up with metallic wire. Iodoform was powdered over the sutures, then three pieces of lint, after which a layer of Lister gauze six pieces thick, and over all a bandage placed around the neck. The bandage was kept in place by pieces of string attached to it on each side and then to the roller, while another piece of string was attached to the bandage and carried under the fore legs to the bottom part of the roller in the shape of a martingale. The wound healed rapidly, and the pony did well and eventually put on flesh, thus showing that the interference with the pneumo-gastric did not in any way impair digestion.

This case doing so well, I decided on trying another for experiment, so I procured another pony, and found he also did well after the operation.

I was now ready for the operation on a roarer, and the first case which turned up was a black Waler mare, belonging to Mr R. Crookshank, manager, Kamtouel Indigo Concern. This mare roared after the slightest exertion, and according to the owner had been doing so for a year. She was so bad that he could not even drive her slowly at the trot.

On 6th April 1896, I operated on the mare under chloroform. The wound healed well, and she was discharged under the month.

The owner went to England on leave, so I did not see the mare for some time, but I heard casually after three months that she roared as bad as ever. On 3rd September I happened to go near the factory on inspection duty, and the syce who looked after her told me she did not roar as before. I asked the assistant at the factory to let me drive her, which I did, and found she scarcely made any noise after driving her a mile on a bad road. She did not seem in the least distressed when I pulled up, and she had certainly improved generally since the operation; she had put on flesh, and had a nice bloom to her coat.

The owner returning from England at the beginning of November, I was agreeably surprised with the following communication, unasked for:—

"Dear Sir,—Since my return from England I have driven twice the black Waler mare you operated on for roaring, and ridden her once, and I found a very great, in fact, a surprising change in her for the better. She goes evidently with much more ease than she used to when I left for England, and the roaring is now slight."

Remarks.—Perhaps it may be thought a trifle premature on my part to report this, my first successful case, but I do so with a view to induce my brother professionals to try the operation. I may also be excused for being sanguine when it is remembered that I had what I

consider an extraordinary improvement in this case after operation. I hope to be able to report other cases later on, but it is not so easy to get roarers here as in Europe.

Abstract and Report.

A DISEASE OF THE HORSE SIMULATING FARCY.

In a recent number of the *Annales de L'Institut Pasteur*,[1] Nocard describes a disease of the horse which cannot be distinguished from farcy by its clinical characters, but which is caused by a bacillus distinct from the glanders bacillus. The main clinical features of the disease are illustrated by the two following cases.

Case I.—A stud mare, aged fourteen years. On the 21st of May, in the morning, this animal was found so lame that it walked on three legs. The right hind limb was rested on the toe and swollen from the fetlock to above the hock, the swelling being hot, œdematous, and very sensitive. The mare had worked as usual on the previous day. On the 22nd the swelling was less marked and less sensitive, and the foot was put to the ground somewhat better. On the 23rd a small abscess burst on the inner aspect of the fetlock, leaving a deep unhealthy-looking wound. On the 24th three similar buds showed themselves on the inner aspect of the hock; these were fluctuating, slightly sensitive, and connected by a sort of sinuous cord, which ascended alongside of the saphenic vein to near the middle of the thigh. On the 25th these three buds on the hock burst, giving exit to a yellowish, fluid, grumous pus, and leaving raw, ulcerated, unhealthy-looking wounds. The lymphatic cord observed on the previous day had become more prominent, and presented on its course four rounded swellings, analogous to those which on the previous day existed at the level of the hock. The inguinal lymphatic glands were soft and not painful. On the 26th of May the buds on the inner aspect of the thigh had also ulcerated, and the owner then brought the animal for consultation to the Veterinary College at Alfort, where it was isolated as *highly suspected of farcy*.

At this date the affected limb was still engorged, œdematous, hot, sensitive to pressure throughout almost its whole length; at the same time, however, it was put freely to the ground. At the inner face of the limb, from the hock as far as the fold of the groin, there was present a cord as thick as the finger, sinuous in outline and rather firm in consistence; it followed exactly the line of the saphenic vein. At the level of the hock this cord ended in an ulcer with abrupt edges and equal in diameter to a franc piece; from this there escaped a little viscous pus streaked with blood. At the inner face of the leg the cord presented below two identical ulcerations, and higher up three rounded nodosities of the size of a small nut; these were distinctly fluctuating and not yet ulcerated. Finally, at the internal face of the fetlock and at the lower part of the metatarsus there were several ulcerated wounds, similar to the preceding, but less deep and not quite so unhealthy-looking. There was no induration of the inguinal lymphatic glands.

So far as could be judged from the clinical signs, this animal would have been strongly suspected of farcy, but as is the custom in all such cases, before giving a definite diagnosis, a little pus was taken from one of the buds on the inner

[1] November 1896.

aspect of the leg and used to inoculate potato, serum, and bouillon. The same material was also used for the intraperitoneal inoculation of two male guinea-pigs, and the mare was submitted to the mallein test. The mean temperature before the injection of mallein had been 38·2° C., and the highest temperature reached during the twenty-one hours after the injection was 38·5°. During that time the general health of the animal was not disturbed; it remained lively and retained its appetite. The local swelling was small, not at all sensitive, and it disappeared in twenty-four hours. In short, the mallein did not provoke any reaction, either organic or thermal.

On the 29th of May, forty-eight hours after inoculation, the inoculated guinea-pigs showed an intense inflammatory orchitis, the scrotum being hot, painful, shining, and violet-red in colour. The testicles were adherent to their envelopes and could not be returned into the abdomen. On the 30th May one of the guinea-pigs was killed, and the *post-mortem* of it showed that the two layers of the tunica vaginalis were united to one another by a thick purulent exudate. The omentum was thickened and inflamed and showed a large number of purulent centres. The peritoneal cavity contained a small quantity of viscous liquid with specks of pus. When stained by the method of Gram-Nicolle the pus of the tunica vaginalis, of the peritoneum, and of the omentum was found to be very rich in clusters of small bacilli, varying somewhat in form and all deeply stained of a violet colour.

The potatoes inoculated on the 27th of May yielded by the 29th a thin, dry, pulverulent culture, of a dirty white colour, very different from a culture of the glanders bacillus. The tubes of blood serum (from horse's blood) showed a large number of round, shining, whitish colonies. At the bottom of the bouillon flasks there were deposited, like a powder, very small whitish grains, which on agitation rose into the fluid and remained suspended in it. In all these cultures there had developed, in a state of purity, a short bacillus differentiated from the glanders bacillus by the fact that it stained well by Gram's method.

These experiments warranted the diagnosis "not farcy." The mare was kept under close observation, and each day the buds which had formed since the previous day were opened, and morning and evening the ulcerating wounds were bathed with a 3 per cent. solution of cresyl, and powdered with plaster medicated with the same substance. Under the influence of this treatment the ulcers cicatrised with surprising rapidity, and in a few days the wounds filled up and became covered with epidermis, leaving a cicatrix slightly deformed and devoid of hair. However, as fast as the old ulcers healed up new buds developed above them on the course of the inflamed lymphatics, underwent the same rapid evolution, and quickly cicatrised. Throughout the whole time the inguinal lymphatic glands remained unaffected. Later on lesions appeared in other parts of the body. On the 5th of June, on the left side of the thorax, at the level of the eighth and ninth ribs, a veritable cystic tumour, as large as the hand, formed; this was indolent and uniformly fluctuating. Puncture of the swelling gave exit to a large quantity of whitish pus of good appearance, and a bacteriological examination of this showed that it was very rich in bacilli which stained by Gram's method. Under careful dressing with solution of cresyl this large cavity cicatrised completely in a few days. On the 7th of June an analogous cystic tumour, but somewhat smaller than the preceding, appeared at the lower part of the left hip; this gradually increased in volume, and when opened on the 11th of June, it gave exit to 200 grammes of reddish liquid pus, very rich in the specific bacilli. On the 12th of June the right hind fetlock, which had appeared completely recovered, became the seat of a large hot sensitive swelling; three fluctuating points were present on this swelling, and when punctured they gave exit to a

yellowish thready pus. On th 13th the abscesses opened on the previous day had become transformed into deep ulcerations with an unhealthy aspect; these were treated with cresyl lotion. By the 15th the ulcerations in the fetlock had filled up and were on a fair way to cicatrisation, but there now appeared on the outer face of the right metatarsal bone a fluctuating swelling, which, when opened, gave exit to a thick grumous pus rich in masses of bacilli. This again was transformed into a deep, unhealthy-looking, ulcerating wound, which did not disappear until about the 25th of June.

On the 20th of June a similar small abscess appeared on the inner aspect of the metatarsus of the same limb; this quickly burst and was transformed into a deep ulceration, which persisted for several days before cicatrisation was complete.

On the 26th of June a hot, painful, fluctuating swelling developed on the chest wall, above and a little to the left of the sternum; it burst spontaneously on the 1st of July, discharging a large quantity of pus, and leaving a deep, ulcerating, irregular wound of a very unhealthy aspect.

On the 29th of June the off-fore fetlock was swollen, hot, and painful. Throughout the day the animal was uneasy, scraped with its feet, lay down and got up again, and looked round at its flank. Notwithstanding these symptoms of colic the dung and urine were passed as usual. On the 1st of July three new abscesses burst on the off fetlock and left deep ulcerations.

On the 2nd of July there was observed at the inner aspect of the left thigh a sinuous lymphatic cord leading up to the fold of the groin and ending in a large, painful, hot, and fluctuating tumour, which appeared to have its seat in the mammary gland. Puncture of this gave exit to a reddish, grumous, rather thin pus, which was rich in masses of bacilli.

On the 6th of July the animal was unable to bear weight on the near hind limb, which was swollen throughout its whole length; the swollen limb was very sensitive to pressure, especially at the level of the hock. On the 7th of July four or five small abscesses formed on the near hock, and became converted into ulcerating wounds. On the 8th of July new ulcerations formed on the inner aspect of the off hind leg, which had appeared to be completely recovered. The limb at this time was not swollen, and the animal was not lame on it.

Up to the 19th of July the condition of the animal remained stationary. The ulcerating wounds gradually cicatrised, although the animal lost condition. On the 19th of July the animal was found standing on three legs, the left hind limb being raised from the ground; the whole of the thigh was engorged, tense, hot, and very painful on pressure. As death appeared to be imminent, the animal was killed by bleeding. The *post-mortem* examination revealed the following lesions:—

Starting from the left mammary gland a large abscess had underrun the internal crural aponeurosis, the pus being infiltrated between the muscles of the region. The pus here was liquid, streaked with blood, and grumous, and it enclosed in abundance, and in apparently pure culture, masses of the bacilli already described. The inguinal lymphatic glands were a little infiltrated, but otherwise healthy, as were also the sublumbar glands. On the contrary, a lymphatic cord as thick as the thumb, œdematous at its periphery and with thick ragged walls, seem to start from the obturator foramen on the left side; it contained grumous pus and ran upwards and forwards to terminate 8 or 10 centimetres from the kidney in a large purulent collection of the volume of a hen's egg. The two kidneys were completely deformed by multiple abscesses varying in dimensions from a pea up to a hen's egg. One of these abscesses alone contained 130 cc. of thick, creamy-white pus of good appearance and very rich in masses of bacilli. All these abscesses were situated in the cortical

layer, and the wall of each was constituted by a thin layer of indurated tissue. Between the abscesses the renal tissue retained its normal aspect. The pyramids were healthy, as was also the renal pelvis, and the bladder contained a little clear, non-albuminous urine. The liver and spleen presented no lesion, and the lungs were free from anything like tubercles or abscesses, but they contained five areas of broncho-pneumonia varying in size from a hazel-nut to a walnut. On section, these showed centrally a branch of the pulmonary artery obstructed by a firm white clot. Culture and inoculation to the guinea-pig showed that these clots contained the specific microbe of this form of lymphangitis, and pus from the renal abscesses yielded the same organism in culture. On the contrary, cultures made from the heart and spleen pulp remained sterile.

CASE II.—A horse, aged twelve years. For several years the off hind leg had been the seat of an indurated engorgement, at the level of which there formed from time to time small abscesses which burst spontaneously, causing small ulcerated wounds and leaving irregular, projecting, hairless cicatrices. The animal had continued to work the whole time.

When brought to the clinique of the Alfort Veterinary College there existed in the fold of the pastern a deep fissure, from which the animal was very lame. The affected limb was double the normal thickness from the fetlock to the hock. In the region of the tendons it was markedly indurated, and covered with old, irregular, and painless cicatrices. At the level of the head of the external metatarsal bone there existed an abscess of the size of a hazel-nut, and this, when opened, gave exit to a little yellowish thready pus, and left a deep, ragged, unhealthy-looking wound. On the inner aspect of the leg at its lower part there existed a similar abscess still intact; this was slightly sensitive, œdematous, and fluctuating, and from it a sinuous lymphatic cord ascended alongside the saphena vein. The inguinal lymphatic glands were a little infiltrated.

The animal was isolated as suspected of farcy, and it was submitted to the mallein test. At the same time a little pus, collected in a state of purity from the centre of an intact abscess, was used to inoculate two male guinea-pigs and tubes of culture media. Before injection of mallein the temperature had been 38·8° C., and the highest temperature reached during the twenty-one hours after injection was 39·1°. During this time the horse retained his appetite and remained lively, while the local swelling was only slightly sensitive and entirely disappeared within thirty hours. There was thus no reaction to the mallein test.

On the third day after inoculation the two guinea-pigs showed intense inflammatory orchitis, and pus obtained from the tunica vaginalis was found to be free from glanders bacilli, but to be very rich in bacilli staining by the method of Gram. All the artificial media inoculated also yielded this same bacillus.

After the fissure of the pastern had healed up the animal was returned to its owner, and it continued to work, although small abscesses formed from time to time on the off hind leg. Under treatment with cresylic lotion these abscesses rapidly healed up. In process of time the lesions, which at first had been situated mainly in the metatarsal region, spread to the lower part of the leg.

From a clinical point of view Nocard regards exemption of the lymphatic glands in this disease as of great importance. In no case that has come under his observation have the inguinal lymphatic glands of the affected limb been involved; they were sometimes increased in size and infiltrated, but never became indurated, or the seat of suppuration. In several cases it seemed that the lymphangitis obviously had its starting-point in a fissure of the pastern, or of the front of the hock, but as a rule the starting-point of the lesions could

not be discovered. In one case the disease lasted for several years; one of the hind legs was the seat of an indurated engorgement, on the surface of which, from time to time, but only during the winter, small abscesses slowly evolved, ulcerated, and then slowly filled up, leaving an irregular prominent cicatrix. During the summer the abscesses completely disappeared, and the animal appeared to have made an absolute recovery, but when the cold weather set in the disease broke out again. Three of the cases terminated fatally after some weeks or months, and in these the *post-mortem* examination showed that suppuration had extended along the lymphatic trunks to the kidney. Lesions were never found in the spleen, liver, or lungs, with the exception of the areas of broncho-pneumonia described in one of the foregoing cases.

Out of the total series of nineteen cases observed, only two came from the same stable. In that instance the first animal attacked made a quick recovery, and some months afterwards the disease attacked the second horse in the same stable, and proved fatal after two months. It is, therefore, concluded that this form of lymphangitis is not very serious as regards its tendency to spread by contagion.

When a coverglass preparation from the pus of one of the small abscesses is stained by the method of Gram-Nicolle it is found to be very rich in microbes, many of which are included within the cells, although the majority are free. They are generally found associated in close clumps, though they also occur isolated between cells or in their interior. The majority have a distinct bacillary form, rather thick, short, and rounded at the extremities. As a rule they are disposed parallel to one another, but sometimes they are arranged in linear series. In such a case the thickness of the various segments increases up to the terminal one, which is swollen in the form of a club. Sometimes they are thickest at the centre, and somewhat pointed towards the extremities; and occasionally the organism takes the form of short, rounded, or almost ovoid bacteria. All these different forms may be encountered in the same clump, and sometimes even in the same leucocyte, and it was found that whatever was the form of the microbe its mode of growth in artificial media was always the same.

The organism was found to be easily cultivated in the majority of media usually employed, and it grew at any temperature between 30° and 40° C. Peptonised bouillon was found to be an especially favourable medium for its cultivation. After the third day the bottom of the flasks showed a multitude of very small whitish grains at the bottom of the flask; the liquid above these remained limpid. Sometimes a thin growth formed on the surface of the bouillon, but this was easily dispersed on agitation. The form assumed by the organism when cultivated in bouillon varied somewhat according to the age of the culture; after twenty-four to forty-eight hours they took the form of slender homogeneous bacilli, somewhat resembling the diphtheria bacillus in shape and arrangement. In older cultures some of the organisms become swollen about their centre or at one extremity, and others were very thick and transversely striated. In peptonised glycerine bouillon the deposit at the bottom of the flask, was not in the form of small grains, but like an amorphous whitish precipitate easily dispersed on agitation. In this medium the organism never assumed the bacillary form, but always the form of rounded or ovoid cocco-bacteria.

In peptonised gelatin no growth takes place at ordinary room temperatures, but when incubated a rather meagre growth of small whitish grains develops in the depth.

On agar the microbe develops under the form of small, opaque, rounded, whitish colonies, with crenated edges and projecting centres. After some days' incubation the colony spreads over the surface of the agar under the form of a thin, humid, opaque, finely plicated membrane, not adherent to the medium.

Even when inoculated with abundance of material, potato yields only a meagre growth in the form of a thin dry powdery stratum, dirty white in colour, and festooned at its edges. The most characteristic form of growth is exhibited when the organism is cultivated on gelatinised serum. The isolated colonies here take the form of round, shining spots, with very sharp edges, resembling the segment of a sphere of large radius. Sometimes the centre of the colony is distinctly projecting. Gradually this colony sends downward into the serum numerous roots, many of which acquire a diameter greater than that of the colony itself. The appearance of the growth then recalls a culture of the actinomyces on glycerine agar.

A remarkable point observed was that the colour of the growth was different according as the serum was obtained from the blood of the horse or from the blood of the ox. On serum from the horse the colonies are white, whereas on ox blood serum they are a more or less intense yellow, the colour being sometimes deeper than that of the staphylococcus aureus.

No growth takes place in the absence of air, and the reaction of the medium is not appreciably altered, remaining neutral or slightly alkaline even when the growth is very abundant.

Milk is not coagulated, and the growth in that medium is rather slow. In artificial cultures the organism retains its virulence for a long time, even for three or four months.

Exposure to a temperature of 65° C. is fatal to the organism in a quarter of an hour; at 58° C. it is fatal in one hour.

Experiments show that the organism is pathogenic to the horse, ass, mule, guinea-pig, rabbit, pigeon, and white mouse. The pigeon, however, offers considerable resistance, and the common fowl is immune.

In the case of the horse, ass, and mule, subcutaneous inoculation of pus or artificial cultures provokes an acute abscess, which bursts spontaneously in about six or ten days, and discharges a thick grumous pus. The cavity of the abscess closes up slowly, and leaves a persistent cicatrix. In only one instance was subcutaneous inoculation followed by the development of a progressive ulcerative lymphangitis analogous to the natural disease. The inoculation in that instance was performed as follows:—The subject of experiment was a fourteen-years-old healthy mare. A narrow, probe-pointed tenotomy knife was inserted under the skin at the internal face of the leg a little above the hock, and used to sever the subcutaneous cellular tissue, as well as the saphena vein and the lymphatic vessels surrounding it. On the following day the animal was very lame on this limb, and the inner face of the leg carried a large tumefaction of the size of an orange, slightly fluctuating, hot, and painful. On the following day the fluctuation had disappeared, and the tumour was less sensitive and firm; it crepitated under pressure. On the next day (28th September) two drops of a recent culture were injected into the upper part of this blood tumour. On the 1st October slight suppuration was perceptible at the seat of injection, and on the 3rd October the whole mass of the blood tumour was fluctuating, and when incised it allowed the escape of a large quantity of thick reddish pus, mixed with blood clot. When dressed twice daily with antiseptic lotion the cavity quickly closed up, and it had completely cicatrised by the 8th October; but before this, namely, on the 6th October, the lymphatic vessels accompanying the saphena vein had become inflamed, and formed an irregular sinuous cord as thick as a writing pencil. This cord was soft, hot, and painful, and towards the superior side of the leg it carried two buds, which first became fluctuating, and then burst, allowing the escape of a thick white pus. The resulting wounds had a very unhealthy appearance, and bore a close resemblance to farcy sores. However, when dressed with antiseptic lotion, they cicatrised in three or four days. Three other similar abscesses subsequently appeared on the inner surface of the limb.

PROFESSOR WILLIAMS' REPORT REGARDING CATTLE DISEASE IN JAMAICA.[1]

DURING the month of August we visited the parishes of St. Ann, St. Mary, Trelawny, and Portland, and found the disease upon most of the pens visited. I may state, however, that we found no chronic wasting disease in Trelawny. We investigated one outbreak of an acute disease, having a great resemblance to the acute form of Texas fever, upon this pen. We also examined sugar estates and found that the working oxen on those estates were peculiarly free from the "wasting disease." I was much impressed with this fact and considered that the better feeding increased the vital resistance of the animals to the action of exciting causes of the disease, but found that this could not be considered to be the case as we met with the disease on sugar estates in other parishes that had carried off on one estate 120 head in about five weeks out of 200 working cattle.

We found that anthrax had been very fatal upon two other sugar estates that we visited; we also found that the organism, bacillus anthracis, causing the disease, existed in the waste dunder and that the ponds were imperfectly protected and that during heavy rains the overflow from the waste dunder had access to the drinking ponds. There was in one case an attempt made to prevent this, a shallow drain being made at the lower end of the waste dunder heap, but this drain during heavy rains would be easily overflown, and the contaminated water could flow into the pond. The water in this pond was impure, and we were able to detect a few bacilli in a sample which we took away with us, and to grow them as well as those found in the dunder, in "cultivation media," that is to say, certain soups and jellies prepared for the purpose, and brought with us from Scotland. We arrived at another sugar estate immediately after a very heavy shower of rain, and found a boy cleaning out an open drain at the bottom of the yard. We took a sample of the dunder thrown out of the drain and found the anthrax bacilli in smaller numbers than in the other case. Occasional cases of anthrax had prevailed here for some years.

The skimmings of a boiler, *i.e.*, boiling dunder, was examined and found to be free from bacilli, so we conclude that the bacilli are in the ground upon which the dunder is laid, and that during the rains some of them are washed out into the drinking ponds and become mixed with the dunder, which forms a suitable soil for their further development. This source of danger should be kept in view and means taken, upon estates where anthrax prevails, to destroy the infected dunder.

During the whole of the month of August we found that, with four exceptions, the symptoms during life and the *post-mortem* appearances in all the cattle examined were peculiarly identical. The symptoms in the four exceptions referred to differed in many essential particulars from those presented by the "wasting disease." The first case (on a sugar estate) was a brindled steer, very emaciated, hide bound, and on examination gave evidence of lung disease, said to have no cough, but he coughed during our visit, and very feeble. His temperature, however, was only 101° F., and his pulse 55 per minute. The owner said he had "tuberculosis," and that he had lost others which had suffered in a similar way. Upon making a *post-mortem* examination it was found that the disease was broncho-pneumonia, that is to say, inflammation or the bronchial tubes and of the substance of the lungs arising from an ordinary cold, or as a result of previous invasion of "lung worm" strongyles micrurus. I may here state that I have been informed that some cattle have been condemned in the island as having had the contagious lung disease pleuro

[1] Supplement to the Jamaica Gazette, 1st October 1896.

pneumonia contagiosa, the appearances of which are not dissimilar to those of the one under consideration. I therefore take the liberty of suggesting to Meat Inspectors that they should make themselves acquainted with the differences between the two diseases, as much injury might be inflicted upon the colony if mistakes of this kind were repeated. The second case, which scarcely bears upon the subject of this report, left apparently well at night, was found dead in the pen in the morning (supposed to have died from anthrax). The *post-mortem* revealed nothing particular, except an inflammatory ulcer in the fourth stomach, which along with the other three stomachs and bowels were greatly distended with gas. This formation of gas might have been *post-mortem*, but I was of opinion that it had occurred previous to, and was the cause of, death.

The third exception occurred in the parish of Trelawny, where we were informed that five cattle had died within the last few days, but we could not obtain a very satisfactory account of the symptoms and *post-mortem* appearances.

There was one sick two-year-old steer alive and presenting the following symptoms:—Great dejection, breathing rather quickly, tucked-up belly; pulse 53 per minute; temperature 103° F. The mucous membranes of the mouth, nose, and eyes were of a deep yellow colour, urine tinged with bile, rumination suspended, but the bowels were acting normally; the most important symptom here was the yellowness of the mucous membranes, pointing to a diseased or disordered condition of the liver, and on *post-mortem* examination this was found to be the case, the organ being enlarged, of a pale yellow colour, and when cut into, the cut surface presenting a uniform brownish yellow colour, discharging a little thick dark coloured blood from the cut veins. In this particular, and in the appearance of the blood under the microscope, this case presented two of the most important conditions of Texas fever; but other conditions observed in that disease, with the exception of a general bloodlessness (anæmia), were absent. The animal, however, was covered with ticks, many of them being what is described to me as being previously unknown in this country.

The fourth exception was a working Carthagenian bullock which had been in this country four years, met with near Port Antonio—but not on a sugar estate —on examination, previous to slaughter, symptoms of extensive lung disease were detected, in addition to a yellowish pallor of the mucous membranes, with cough, and hurried respirations, the temperature was 102·5° F., respiration 54 short catching, and pulse 80 per minute.

The *post-mortem* examination of this bullock revealed an immense number of flukes in the liver, and of strongyles in the lungs, one side of which being consolidated and presenting a marbled appearance—the bronchial tubes being filled with strongyles. The remaining lobes containing some strongyles were enlarged, distended with air—in fact emphysematous—by having to admit some extra air to compensate for the imperviousness of the other lobes. This animal was covered with ticks, which were mostly of the reddish brown colour characteristic of the new variety. It was observed, as we approached this part of the Island, that this kind of tick became much more numerous, whilst the silver back and the blue tick were found in smaller numbers. It was also found that the Texan cattle are here in greater numbers.

The pastures on this pen are exceedingly damp, many of them being morasses or bogs, favourable to the development of the strongyles and of flukes, several other cattle on this pen presented similar symptoms.

In pursuing this investigation I have had to consider various theories and opinions as to the cause and origin of the "wasting disease" and amongst them I may consider the following:—

1st. Drinking pond water.

2nd. Tuberculosis.
3rd. Starvation.
4th. In-and-in-breeding.
5th. Strongylus contortus and other strongyles.
6th. The influence of ticks following some previously diseased condition.
7th. The direct effect of the tick.
8th. Texan fever.

1st. Drinking Pond Water.—So far as the "wasting disease" is concerned this has no effect, as the disease is as common amongst cattle that drink the water from springs and running streams. There are, however, two sources of danger in this water, namely, contamination with the anthrax bacilli as already referred to and with the strongylus contortus referred to hereafter. I may, however, state that the water in most of the ponds was in a semi-putrid state. In some ponds low forms of vegetation were found in the form of a green scum; these are varieties of protococci and algae, and it is asserted by bacteriologists that these low forms of vegetation form certain anti-ptomaines, that is to say, antidotes to other growths which develop poisonous ptomaines, *i.e.* virulent or poisonous products. Anyhow their presence in the water does no harm and their growth should be encouraged. The water in all the ponds is soft and deficient in saline materials, and it is stated, a statement which we have corroborated, that cattle thrive better, and are freer from disease when the drinking water is brackish; this points to a deficiency of saline matters in the food and water. At Rio Bueno we had the opportunity of examining some cattle that were resting near the sea; they looked uncommonly well, and were free from ticks. These cattle drank brackish water and preferred it to other water.

2nd. Tuberculosis.—I am glad to say that we found no evidence of tuberculosis in any of the animals examined in the parishes of St. Ann, St. Mary, Portland, Trelawney, St. Elizabeth, Manchester, St. James, Hanover, Westmoreland, Clarendon, St. Catherine or St. Thomas, and we had no opportunity of seeing any in the remaining parishes of Kingston and St. Andrew.

The cattle owners generally ought to be very thankful for the absence of this dreadful disease, and in order to protect the Island, a period of quarantine should be imposed upon all newly imported cattle, and the tuberculin test applied particularly to those from Great Britain, as tuberculosis prevails there to an enormous extent, among the most highly bred and costly animals, as well as less costly stock. In the city of Edinburgh over 40 per cent of the cattle are tubercular.

I need not point out that tuberculosis is not only contagious and infectious amongst cattle but that its bacillus is the great source of consumption (phthisis) in human beings.

3rd. Starvation.—The disease is attributed by some to want of food. I cannot support this view, so far as the quantity of food is concerned, as in the dry parishes, the pastures though bare for want of rain, the cattle seemed well-filled with food and in those that were examined, *post-mortem*, the stomachs (with the exception of the 4th which was almost empty in some cases) were fairly filled; so far as quantity is concerned there had been sufficient in the driest district; but as regards quality, that is to say, as regards the constituents contained in the food there is no direct evidence and that will have to be further investigated. I may state, however, that the food found in the stomachs, in the dry districts of the country, was of a hard, indigestible nature containing much woody fibre, and that the walls of the stomachs were attenuated and pallid, seemingly having but little muscular power, as if exhausted with a continuance of over work in overcoming the indigestibility of their contents.

4th. In-and-in or too Close Breeding.—Maintained by some, that, as a result of too close breeding the constitution of the cattle has been weakened and that the disease is merely an evidence of weakness of constitution.

There are no facts to support this assertion, indeed the reverse is the case; the herds being composed of many breeds; from fairly typical Highlanders; many examples of Devon, some of the Hereford type and a few fairly bred shorthorns, in addition to Indian cattle, the old Brahmin and the lately imported Mysores, of which I cannot speak too highly as from the evidence brought forward they seem to resist the attack of ticks, and to have immunity from the disease.

I am of opinion that the Jamaican cattle are of a peculiarly strong and hardy character, had it been otherwise, the mortality from the "wasting disease" would have been more disastrous.

5th. The Strongylus Contortus.—This parasite was found in eleven cases out of twenty-two examined *post-mortem* during August, but with the exception of two cases in a three-year-old steer and a calf about three months old, they were few in number, and even in the calf and steer they were not sufficiently numerous to cause great danger to health. Altogether the contortus was found in about 40 per cent. of the stomachs examined during the investigation in August and September.

* * * * * * * [1]

I wish to draw particular attention to this fact, as it has been supposed that this worm was the cause of the wasting disease, and some have asserted that although the worms were not present in the cattle, they had been there, and had been removed by medicine, and that the existence of the disease was only a continuance of the damage done by the worms. In answer to these assertions, I have to state that the disease caused by the strongylus contortus disappears in a short time after the worms have been destroyed; and in further corroboration of these conclusions I had the opportunity of making a *post-mortem* of a calf three weeks old, which, along with its dam, was slaughtered, suffering from the wasting disease and covered with ticks, and found the characteristic anæmia or bloodlessness, with the solid organs healthy, and no strongylus contortus, although its dam had a few in her stomach. This cow had no milk, and the calf although only three weeks old had its stomachs fairly filled with solid food, and had a few large round worms, ascaris lumbricordes, in the intestine.

I attach great importance to this, as it points along with other cases cited when river water was drank that the "wasting disease" exists independently of the strongylus contortus.

6. *The Results of Ticks following some previous Disorder or Disease.*—A general opinion prevails that ticks do not, at least in any great numbers, attack healthy cattle, and that those which they infest are already under the influence of some disease, or in a disordered condition.

This opinion is true to a very limited extent only, but is in accordance with the general law that parasites of all kinds seem to prefer the weak to the strong; but, and particularly in this disease, it does not follow that the healthy and strong are exempt from attack. I may, however, point out that newly calved cows are very liable to attack, and not infrequently the mother is seen covered with ticks, and presenting signs of disease, whilst the offspring is comparatively free from ticks, and, if old enough to eat sufficient grass, to maintain its health, and present a fairly thrifty appearance; but if too young for this, and the dam short of milk—as is too frequently the case—the calf becomes emaciated, sometimes covered with ticks, sometimes fairly free from

[1] The paragraphs here omitted relate to the life history of the strongylus contortus, and its presence among sheep and goats in Jamaica.

the parasites, but suffering from anæmia, "white sores," and other conditions pointing to actual starvation.

The "*white sores*," also called bovine farcy, above referred to, consist of varying-sized abscesses and ulcers upon many parts of the body, particularly the dewlap, the under parts of the chest, in front of the shoulder, and on the fetlocks and hocks. They result from accidental wounds or bruises, and from bites of ticks, and, consequent upon the anæmic (bloodless) condition of the patient, the process of healing becomes impossible, in fact if a breach in the skin occurs from any accidental circumstance, instead of the healing process taking place, the tissue surrounding such breach is too bloodless and feeble to resist the microbes of suppuration; the destructive process consequently extends from the circumference of the original wound or puncture to the surrounding tissues, and the sore, which at first might have been a very small one, becomes an unhealthy looking wound the size of half-a-crown, or even larger, with pale, unhealthy, and ragged borders, the surrounding skin being often of a tough, leathery consistence, and presenting little or no signs of vitality, the ulcerative process at the same time extending deeply into the subcutaneous structures, forming cavities of varying dimensions, generally filled with the larvæ of flies—"maggots or large fly-blows"—which cause much irritation, the discharge of fœtid material, and increase the fever and tendency to death.

Very few of these calves recover, and certainly when they have reached that stage in which I have generally seen them, recovery seems an impossibility.

The treatment adopted is barbarous and absurd, being entirely local, the remedies calculated to diminish the reparative powers of the economy, and thus increase the destruction of the tissues surrounding the wound.

It should be remembered that the inability or failure to repair is due to the fact that blood, the conveyer of nutritive materials to all parts of the body, is deficient in those materials, that the animal is in a condition of starvation, and that whilst such is the case, it is as reasonable to expect the parts to be restored to their natural healthy condition as it is to expect a man to repair a ship or a house without materials, therefore the first step in combating this very serious disease—the result of which will be felt hereafter, as the mortality has been 20, 40, or even 100 per cent.—is to supply the calf with reparative materials in the form of food, that of the mother being totally inadequate whilst suffering from the disease or even from dryness of the pastures. There are many articles in the island that might be utilised for this purpose, such as molasses, cocoanuts, breadnut leaves, cane tops, cornmeal, wheat, middlings, etc.

I may mention that there is a disease on the continent of Europe called the "summer sores of horses" which bears some resemblance to the "white sores" of Jamaican calves, and due, at least, in a great number of cases, to the presence of a larval nematode in the substance of the skin; and the sores in which they are found—like the "white sores" of calves, and sores generally seen both in horses and cattle in Jamaica—have a tendency to spread; they then become covered with a soft pulpy layer of granulations having a reddish brown colour, intermixed with serous pus, or a pulpy matter that covers the whole.

At first the sores are irregular, but gradually extending, they assume a circular form, having a varying diameter and situated particularly upon those regions most subject to wounds and bruises, such as those on which the harness rests, and upon the extremities of the limbs. Unlike the "white sores" this disease gives rise to intolerable itching, a symptom which I have not observed in the calves here; but like the "white sores" it is difficult to cure, many agents having been tried, the majority proving of no value. Caustics constantly fail, but good results have been obtained from the

application of yellow sulphide of arsenic spread very thinly over the surface of the sore, one application being sufficient to cause a scab to form, which becomes detached in eight or ten days, leaving a simple, healthy-looking wound. Success has also been obtained by the application of chloroform and iodoform applied every day, afterwards protecting the parts by a layer of collodion, or what I usually employ as being much cheaper—a rapidly drying varnish (spirit varnish). Similar treatment might advantageously be applied here, not forgetting what has been already stated that reparative materials must be supplied by suitable food, and the parts protected from flies, and also that the process of repair is much more effective when the animal is kept in a shed, and prevented from exhausting its already enfeebled powers.

Calves, whilst not immune from the wasting disease, seem to be less liable to it than older animals. I have noticed several instances in which the dam was suffering from the disease and covered with ticks, that the calf has seemed healthy and having but few ticks upon its skin; the converse is however sometimes the case, and the calf will be found suffering from disease, covered with ticks, while the dam is apparently well and fairly free from ticks; but this is less frequently met with than the converse condition.

These facts agree with the observations of Dr Theobold Smith and F. L. Kilborne (Investigations into the nature, causation, and prevention of Texas or Southern cattle fever, Washington, 1893) who state: "In general, calves are not insusceptible to Texas fever; but the disease is milder and the mortality is lower than with those of more than one year old;" and then again: "Young animals seem to be largely proof against a fatal infection, although they are by no means insusceptible. The repeated mild attacks to which they are subject finally makes the system indifferent to the virus. The introduction of young animals into the permanently infected territory, though not without danger, is far safer than the introduction of animals older than one year. The danger of fatal infection increases with the age of the animal, and is very great in cows over five or six years old.

The ages of the calves experimented upon in America were from five weeks to six months, those under two months old died, whilst the mortality seems to have been less on those of a greater age, except in the case of the calf six months old.

I refer to these facts and experiments in order to point out the importance of assisting a calf over an attack of disease by supplementing the supply of its natural food, *i.e.*, milk, when that is defective in quality or deficient in quantity, and thus prevent the occurrence of white sores and a fatal termination.

8. *The Direct Effect of Ticks* in causing the disease in both strong and debilitated cattle. As already stated cattle enfeebled from any cause seem to form a more favourable habitat to the ticks, and are more predisposed to the disease than the healthy and strong, but the healthy and strong have no immunity, as they are frequently attacked and succumb. I have therefore arrived at the conclusion, after carefully weighing all the facts and circumstances which have been brought before me both directly and indirectly, that the disease is due to the attacks of ticks, and (with the exception of the Mysore cattle) that no cattle have immunity. Some are but slightly invaded by the ticks; some, owing to the strength of constitution or some other cause seem to throw off the results with but little appreciable suffering or damage, whilst in others, attacks are acute and terminate fatally in a few days after the first manifestation of the symptoms. And I re-assert that after carefully weighing the evidences I have arrived at the conclusion that the disease is, as presented to me, a modified form of Texas fever now prevailing in other parts of the world besides Jamaica, and that it is carried from place to place by ticks.

The disease in itself cannot be called contagious or infectious, there is therefore no necessity for burning the carcases of dead animals.

Animals suffering from the disease, if perfectly freed from ticks, do not transmit the disease no matter how severe the attack might be, but if invaded by the parasite the pastures on which they graze are first contaminated by the mature ticks which drop off their bodies, and in about seven days lay their eggs in the grass which hatch in about other twenty days—sometimes a longer period—and the young ticks are at once ready to crawl on the cattle. If these figures are added together it will be found that the shortest possible time, after tick-infected cattle are turned out into a field, in which the disease may appear, is about thirty-seven days, but the period of first attacks may be much longer than this as all the eggs are not laid upon the same day, there is therefore a daily hatching for consecutive days. (Own observations. Texan ticks placed in bottle on 5th September, commence to lay on 17th.)

It is rather unfortunate that during the earlier part of our visit, the animals examined, both prior to and after death, were suffering from the disease in its chronic form, and in which many of the marked symptoms and *post-mortem* conditions of Texas fever were absent, but during the latter portion of the visit more decidedly marked signs of that disease were observed.

One characteristic sign of acute Texan fever (as described by the American writers) red water or blood coloured urine, hæmoglobinuria was absent. They state that—"The one sign regarded as peculiar and pathognomonic (characteristic) in this disease is the discharge of urine having the colour of blood. This colour is not due to a discharge of blood from the kidneys and subsequent breaking up of the red corpuscles, but to a filtration of the colouring matter of broken down red corpuscles (hæmoglobin) already in solution in the circulation into the urine in the excretory structures of the kidneys." This statement is perhaps too obscure to be easily understood. It means that the red blood cells are broken up in the blood vessels, and that the colouring matter thus set free tinges the fluid portion (which is naturally colourless) and which when excreted by the kidneys presents a red appearance. Now, this sign considered so important by the American authors, and stated by them to be present in thirty-three out of forty-six cases, did not present itself except in one doubtful case. The animal (a cow) was suffering from a very prolonged but not severe attack, and had latterly passed red water. I was of opinion, however, that this tinge was due to some injury to or breaking down of the urinary apparatus, as the colour was due to actual (coagulating) blood and not to the colour of broken down blood cells. The information obtained from all who were acquainted with the disease that red water is not a symptom would have caused me much surprise had I not known that in Australia red water is only observed after the animal has been travelled. (One of the constituents of the blood absent in health, viz., albumen was found in all the specimens of urine examined.) Other signs of Texas fever, such as enlargement of the spleen and of the liver, sereo-sanguineous, or red, watery condition of the fat, etc., about the kidneys were absent. The condition of the spleen has in no instance shown the enlargement described by the American writers, but the liver in some three cases has been slightly enlarged, and presenting a pale yellow mottled colour due to bile congestion and fatty degeneration. When cut into the tissue presented a mottled appearance throughout, was bloodless, whilst the larger blood-vessels discharged a very dark-coloured and thick blood. But whilst this characteristic of acute Texas fever was present in these few cases the liver itself did not present the three to five pounds enlargement over that of health, as stated to be the case in that disease; in fact, we did not find one liver to be appreciably increased in weight, but the bile was generally increased in quantity and mixed with mucus. The appearance of the heart also differed from that described in Texas fever, the petechial spots

passing along the intra-ventricular groove and near the base extravasation, etc., being absent, but the heart itself was found to be pale and undergoing a retrograde change as seen in the Texas disease after the subsidence of the fever.

Temperature.—In most cases there was more or less elevation of temperature; in one case it was as low as 101·4° F., this was in a very emaciated and debilitated calf. As a rule, however, the temperature ranged from 103·5° to 106·8° F.

The Appearance of the Blood and Tissues.—With the exceptions already described, the organs and tissues did not to the naked eye materially deviate from those seen in health, there was bloodlessness (anæmia), characterised by pallor of the organs and some degree of degradation of their structures. The blood, however, was thin, watery, pale, in some instances scarcely tinging the fingers of the observer, whilst microscopically it presented those characteristics reported upon by my son Dr Williams.

The symptoms during life were—1st, great depression, the animal presenting signs of languor and debility and indifferent appetite and rumination with emaciation, the loss of flesh being often extreme, the ears drooping and the visible mucous membranes, *i.e.* those of the nose, mouth, eyes, etc., exceeding pale. In one uncomplicated case only did we observe yellowness of these membranes; there was sometimes diarrhœa or purging, but we did not witness one case in which the bowels were constipated, the pulse was exceeding small and weak in all cases, ranging from 65 to 120 beats per minute—about 85 beats however seemed to be a medium, or about twice the natural number; the urine was pale in colour generally, and in all instances when it was tested, contained a small amount of albumen; the breathing except in calves or when the animal was disturbed was about 20 movements per minute, or about $\frac{1}{8}$ more than the natural number, there was no cough, discharge from the nose, nor other signs of disease of the lungs, except in the cases already cited, the eyes had a sunken appearance and the animal had a staggering gait, particularly if hurried or excited. In several instances they fell to the ground when moved sharply or turned round suddenly, in one instance the animal fell down dead, so great was the general prostration and weakness of the heart's action.

The skin about the shoulders, lower portion of the neck and other parts easily rubbed by the animal, was generally denuded of hair and presented a rough, scaly appearance in many instances. This symptom has been described as one preceding the advent of the tick, but such is not the case as it was found, upon close examination, that the skin was covered with ticks underneath the undisturbed hair of the host. I therefore conclude that this symptom is a sequence to and not a precursor of the disease as supposed. Some penkeepers call this "mange," and seem to think that it has no connection with the disease. On close examination it was found that there were not only fully matured parasites present, but many in an embryonic stage, that is to say covered by a shell of thin membrane; upon breaking which, two young ticks, namely, a male and a female were usually found in close contact, the male being of a brownish colour, and having four pairs of longish legs, the female larger, also having four pairs of whitish legs and paler in colour than the male.

The surface of the body was generally more or less covered with ticks which presented at least three varieties, viz.: (1) the large blue cow tick, also called the dog tick, *Ixodes Ricinus*, the first tick known on this island, and not supposed to be injurious; (2) the silver shield tick, *Ixodes Scapulatus*, which clings much more tenaciously to its host, and is difficult to remove: this tick has four maxillary palpi which, when close together, resemble a spear, but separate from each other at their points when the skin is pierced. These two kinds of ticks, as well as the grass lice, or the young ticks of both kinds, are supposed to be non-injurious to cattle, but I cannot subscribe to this as they

must do harm, and at least assist in the induction of the anæmia or bloodlessness which follows. The third form, the one stated to have been unknown by the majority of penkeepers and others until pointed out to them, was brought before my notice about the third day of our investigation having been found shortly before upon a lot of cattle badly attacked by the wasting disease. Upon examining this tick I arrived at the conclusion that it was very similar to, or identical with, specimens of the Texan cattle tick, described as follows by Professor C. V. Riley. *Journal of Medicine and Veterinary Archives*, 1891 and 1892.

Ixodes Bovis.—A reddish coriaceous flattened species, with the body oblong-oval, contracted just behind the middle, and with two longitudinal mpressions above and three below this contraction. Other observers state that the colour of the adult female is not reddish, that the back is olive-brown, and belly slate coloured. This so far agrees with my own observations that very often, as the parasites become matured, the belly assumes a slaty tinge. Like the blue ticks, they do not fasten themselves so persistently and closely as the silver-shield tick, but are easily removed.

The life history of this tick is somewhat as follows: "Adult females kept confined in bottles lay their eggs. These eggs are placed in covered glass dishes containing a little soil and kept in a warm place. After a period of three or four weeks, the young ticks appeared; these were placed on a calf kept in an artificially warmed place, the weather being cold. The earliest or larval stage as it emerged from the egg had three pairs of legs. After one week's sojourn on the calf it was ready to moult. The emerging nymphal stage was provided with an additional pair of legs, and after another week's sojourn on the calf the tick was ready to moult a second time and become sexually mature." We thus find that this tick has two periods of moulting whilst on its host: that it has only three pairs of legs after the first moult, but develops a fourth pair before emerging from its shell a second time, and thus become sexually mature. I may state that I have found the parasite both before and after the second moult, and can confirm the statement that during the larval stage it has only three pairs of legs, and four after its second moult. Experiments have proved that each mature female confined in a bottle remains quiet for several days, from two to four-and-a-half, according to the American observers, but a longer period from eight to twelve days in one case under my notice, then a few eggs will be observed on the mouth and surrounding part. The number of eggs and the period of oviposition vary, when kept in a temperature of 60° to 78°, the laying was observed to continue from eight to fifteen days, and that those ticks which took the longest time, laid the largest number of eggs. Each full-grown female will average 2100 eggs, which appear as dark red brownish masses of oval bodies.

Such then, is very briefly the life history of what was described to me as being unknown in this island until lately.

As all the evidence brought before me pointed out that this tick was unknown to the majority of the cattle owners and their servants, I made application to the Colonial Secretary, the Hon. Fred. Evans, to obtain specimens for me through "The Bureau of Animal Industry, Washington, U.S." of ticks found on Texan cattle, and in compliance with that request, the acting Secretary of that Department sent some specimens which were immediately forwarded to me by the Colonial Secretary. These specimens, collected in Manhatta, Kansas, correspond in every particular with the Ixodes Bovis, also called Boophilus Bovis, etc., found on the cattle here.

Looking upon the tick, and without confining myself to the "foreigner" alone, as the cause of the disease; which it induces first of all by introducing some virulent secretion into the blood of its host which causes fever, alteration in certain organs in acute cases, the development of bodies which may be

living or otherwise into and around the blood-corpuscles, diminish the quantity and deteriorate the quality of the blood, and finally induce death by robbing its victim of its life-sustaining fluid—I am of opinion that every effort must be made to destroy the tick upon the ground and upon the bodies of its hosts. The female tick fully or partly charged with ova, leaves her host and deposits the eggs on the surrounding vegetation and upon the ground, which there remain until they are hatched.

During my investigations into a tick disease in Scotland, it was found that old and withered grasses and decaying vegetable matter of all kinds formed a cover for the ticks, and that they preferred to deposit their eggs where there was an abundant cover, and thus secure their non-destruction during the cold of winter. Although protection against low temperature is not necessary in this climate, there is plenty of evidence to show that when decaying and withered vegetation is allowed to remain on the ground there the ticks will be found, and I have been informed over and over again that during some parts of the year cattle will not face guinea grass; that when placed in such pastures they will show signs of excitement, jump over the fences, and thus abandon even the most luxuriant pasture. Now this proves that the ticks are there in abundance, and no wonder when it is considered that guinea grass, said to be eaten down, leaves a withered stubble often 2 to 3 feet long which forms a cover for the tick to deposit its ova, upon which they hatch and are ready for the first cattle they may come in contact with.

I therefore think, and I express this thought knowing that it will be perhaps severely criticised, that when cattle are removed from guinea grass, the stubble should be destroyed by burning.

I am told that when guinea grass is burnt standing upon the ground, the destruction is imperfect, and that the heat simply favours the hatching of the young ticks, the ova or eggs being under the stones, etc. If this be the case the stubble should be cut down, collected into heaps and burned, the ashes remaining being spread over the land and thus returning something back into the soil. If it be proved by analysis that the soil is deficient in some essential ingredient, this should now be applied, as fertility of the ground not only insures better crops but renders that ground unfavourable to ticks and other parasites, as proved in Scotland by liming and otherwise improving tick-infested pastures. In addition to the destruction of all guinea grass stubble, decaying and dead vegetations of all description should, when possible, be burnt, and the ashes spread over the land. During my travels here I have witnessed many thousand tons of all kinds of vegetable matter allowed to remain on the ground, harbouring vermin and preventing the growth of useful materials, whereas by collecting such refuse into heaps and burning, not only would the harbour for vermin be destroyed, but the ashes so obtained would to some extent, by improving the land, compensate for the trouble and outlay.

With regard to the destruction of the Ticks themselves.—A united effort must be made to remove the cause of the disease by diminishing, or if possible wholly destroying, the ticks; and for the purpose of killing them on their host I have, after due consideration to the cost, and knowing full well that the profit on an £8 to £10 four-year bullock will not allow much expenditure of money, but if money be not spent and an earnest and a united effort be not made, I cannot speak as to the future consequences.

For the destruction of the ticks on the cattle I recommend as the cheapest and most reliable dressing: one part of tar to three parts of boiled linseed oil, applied to all parts of the tick-infested skin; if one dressing be not sufficient, a second should be applied in a few days. All large ticks might be removed by being picked off and carefully destroyed, not thrown upon the ground and stamped upon, but burnt or smothered in tar. Oil destroys the tick by suffo-

cating it, and any oil will do this, but boiled linseed oil is a cheap oil, and being a "drying oil," will remain longer on the surface of the body than a non-drying oil. Jeyes' fluid and sheep wash have proved of service in destroying the ticks, but the mixture of linseed oil and tar will answer the same purpose and cost less money.

In America and Australia cattle dipping is now resorted to, and where the cost can be afforded it should be done in Jamaica, for, after all, it must be confessed that to see the cattle attendants dress an animal is but a sorry sight. If the dressing is not thorough it is money thrown away; every crevice, fold, and depression should be thoroughly dressed, the cavities of the mouth, etc., examined, the ticks removed, and the parts dressed; the eyelids should also be carefully examined, and the ticks gently pulled off.

Every effort should be made to conserve and protect "tick destroyers," such as the black tick birds, of which I see two kinds—one a long billed and the other a short billed bird. I look upon these birds as the greatest friends to the cattle owners. I have had much amusement in watching these birds, as there seems to be an understanding between them and the cattle, whereby they are assisted and encouraged to destroy the ticks.

The domestic fowl is also very valuable as a tick destroyer, and for this purpose it could economically be kept in increased numbers. The long-legged varieties have a great advantage over the shorter legged ones, as they can reach much higher, and thus remove more ticks, which usually do not favour, as least to any great extent, the lower parts of the limbs. Tick-destroying birds, such as the starling, and perhaps the song thrush, might be imported.

To a stranger visiting the island, the scarcity of birds is a striking feature. I have been told that this is due to the mongoose, which has not only diminished the number of wild birds, domestic fowls, but other tick-destroying creatures, such as the ground lizard; now this destruction of the natural tick-destroyers should, as far as possible, be prevented, 1st, by legal protection; 2nd, by encouraging the slaughter of the mongoose, a small reward being offered for every head brought to officers appointed for the purpose of receiving them.

Quarantine.—Being now satisfied that the wasting disease arises from the invasion of ticks, and also that so long as they are allowed to be introduced from without, all internal endeavours to destroy them will be futile unless their introduction from without be prevented. I have therefore to recommend that the following quarantine regulations be enforced upon all cattle imported into the island from tick-infested countries, such as the United States of America, Central and South America, the Leeward Islands, South Africa, Australia, and all other parts of the world where ticks are known to abound, and that until these regulations can be strictly enforced, there should be a total prohibition of cattle importation.

In order to make myself acquainted with the present system of quarantine, I visited the quarantine ground situated at Rock Fort, about 300 yards from the wharf at which the cattle are landed from the vessels.

After landing on and leaving the wharf, the cattle pass along the main road from the wharf to the pens.

There are three large pens, separated one from the other by a roadway 18 feet wide, and fenced by wire fences, strengthened by two wooden rails.

Each of the large pens is provided with a water trough, kept supplied by a pump worked by a wind-mill; the supply of water is sufficient in quantity and seemingly good in quality.

Each large pen is also supplied with a smaller "picking pen," which in turn is sub-divided into two compartments.

This picking pen is for the convenience of purchasers, who there select and brand the cattle they buy.

The pens are provided with good strong gates, and it was stated that the constabulary hold the keys of these gates, which can only be opened by the constable in charge of the station or one of his men.

No two lots of cattle are supposed to mix in one pen. The 18 foot roadway being the means of separation. There appears, however, to be nothing to prevent a new lot of cattle first landed from passing up any of these roadways on their way to their pen, nor to prevent a lot of cattle which had been granted pratique immediately passing down the same way.

The wire fences by which the pens are enclosed are perfectly useless for quarantine purposes, as the ticks, the source of danger, can pass freely from one pen to another.

The posts and wires also form a convenient harbour for the ticks, which are there readily picked up by the cattle when rubbing against a post, etc.

As far as I could gather, the pens have only been cleaned once in five years. The refuse, grass, etc., consequently form a further cover for the ticks, and in wet weather hold the water and form a deep, muddy matter, which of course becomes daily worse as the cattle trample it.

To make the quarantine effective, the pens should be enclosed separately by means of mason work or closely-boarded walls, 5 feet 6 inches high, constructed so that there be no harbour for ticks between the boards or stones.

Each large pen, provided with its picking pen, should be entirely separate from the other large pens.

The pens should be hard-bottomed, and all droppings and waste grasses daily cleaned up and burnt, the pens being kept perfectly clean.

The walls should be regularly whitewashed or tarred so as to destroy all vermin that may be hiding in them.

A "dip" constructed on the Australian or American plan should be provided, and the cattle dipped therein regularly every ten days during their stay in quarantine; the period of quarantine to be three months.

Each animal to be separately inspected, careful search being made by turning up the hair for ticks on the skin, and no animal should be granted "pratique" till the veterinary inspector is thoroughly satisfied by careful examination that it is perfectly free from ticks and from any contagious disease.

SUMMARY.

(*a*) That the disease as witnessed by me is a chronic form of Texan fever conveyed from place to place, and transmitted from one animal to another through the intervention of the tick.

(*b*) The infection is conveyed by the progeny of ticks which have matured on infected cattle, and is inoculated by them directly into the blood of susceptible cattle.

(*c*) It is stated that two mild attacks or one severe one will probably prevent a subsequent fatal attack.

(*d*) That animals under one year old, though not immune, are not so frequently attacked by the slower form of the disease, and that if such be nursed over one or more mild attacks, they may probably obtain immunity. Ticks being the cause of the disease there should—

(1) be a united effort to destroy them on the cattle by external dressings; and on the ground and pastures by burning.

"Dipping ponds," as now used in America and Australia, should, where possible, be preferred to the applications by hand. Plans of the most recent and most effective ponds or baths should be obtained.

(2) To prevent the further introduction of ticks into the country by an effective system of quarantine.

(3) After destroying the ticks on the cattle the "animal strength" should be maintained by keeping it in a quiet sheltered place and feeding well, without causing it to travel for its food.

(4) To avoid drastic medicines. If the cattle drink pond water, it will be safe to conclude that the disease may be complicated and aggravated by the strongylus contortus in the fourth stomach; for the destruction of which, a dose of sulphate of copper should be administered, and, if necessary, repeated two or three times; but when cattle obtain their water out of running streams, or from clean tanks the copper is not necessary. If the animal be feeble, the following may be administered to act as a tonic and as a food, viz.:—Sulphate of iron, nitrate of potash, and common salt (chloride of sodium), of each one dram in a pint of pimento tea, once a day for a week or so.

APPENDIX I.

REPORT ON THE MORBID ANATOMY AND MICROSCOPIC APPEARANCE OF THE WASTING DISEASE.

By T. A. WILLIAMS, M.B., C.M.

As Principal Williams, owing to his constant travel about Jamaica inspecting and examining healthy and diseased herds, has not himself had time for the detailed microscopic and bacteriological examination of the specimens we took from live and dead cattle, this duty devolved upon me. The following is a summary of my observations.

As the enumeration in his report of the many affections to be considered shows, our attention was prominently directed towards the microscopic characters of the blood.

A. In the first place, great anæmia was almost always present. The difficulties in making exact observations with the hæmotocytometer in open pens were considerable and as we had also to make other blood and visceral preparations, which to be of any value must be done with rapidity, the red corpuscles of the blood were enumerated in only a few instances. The smallest number found was 700,000 per cubic millimetre. This number indicates a most profound anæmia, being more than seven times less than the normal number.

The hæmoglobin of the blood was also found greatly diminished, but as far as my limited observations went, not to so great an extent as the number of red cells.

B. The features of the red cells were greatly altered in the more grave cases characteristic of changes in all pernicious anæmias. Their measurement (normally 7·5 micro.) varied from 3 to 9, 10, or even 12 micro. Their shape instead of being perfectly discoid was in many instances irregular with prolongations in all directions. They were often curved on themselves, and were sometimes without pigment. In some I observed a central area about 4 micro. in diameter, which did not stain with basic or acid aniline dyes, surrounded by a more transparent zone about 2 micro. wide staining faintly with basic aniline dyes but becoming decolourised by a weak solution of acetic acid.

C. The white corpuscles did not appear to be esentially modified and no detailed study of them was made.

D. The blood also contained in several cases one or more of the following abnormal bodies:—

(1) In the first acute case observed, that seen in Trelawny, I found a few bodies shaped like a short banana averaging 4·6 micro. long and about 2 micro. broad, very highly refractile and not staining deeply with basic aniline dyes. They were seen only in the red cells, not free in the plasma.

(2) Numerous irregularly rounded bodies about 1·5 micro. in diam. within, generally near the margin of and between the red cells. They were much more numerous in the blood exuding from the cut organs, especially the liver, spleen and above all the kidney. They stained more deeply than the former by Loeffler's method, but were decolourised completely by Gram's method.

(3) Faint bodies, in some foci of a pale brick-red tinge, never observed within but only between the cells.

I do not deem it advisable to enter into the question of whether these bodies are really plasmodia of foreign origin as considered by some, or are merely embryonic or degenerative forms, or pathological modifications of the normal red or white cells or blood-plates.

The purposes of our enquiry are sufficiently served by the fact that the bodies I have observed are identical in essential respects with some of the forms described as being found in the blood by those who have studied that fluid in the disease known as Texas fever.

Any slight differences which may exist between what I and others have seen are only to be expected in view of the modifications which the disease must necessarily exhibit under such various conditions in different countries. The study of this condition is yet in its infancy, and one has only to think of the very striking homology between this disease and malarial fever in man to realise how many differences must necessarily be found in so many forms of the same disease.

The minute examination of organs not apparently abnormal to the naked eye shows the following:—

(1.) The liver:—

(*a*) The liver cells were in some cases, the more acute, in a state of cloudy swelling, their nuclei being almost all obscured. A fatty degeneration of the cells presented in the more chronic cases, and in many a slight amount of abnormal pigment appeared within the cells.

(*b*) The bile capillaries in two cases were full of a dark yellow pigment, appearing as beautiful radii from the central vein of the hepatic lobule.

(*c*) The blood capillaries were visible only here and there, and did not present any abnormality either in their walls or contents. I have not yet observed any abnormal contents in the capillary blood of the organs.

(2.) The chief abnormality in the spleen is the presence of an unusual number of masses of granular sienna-coloured pigment within the large cells of the splenic pulp and the endothelioid cells of the stroma. Also a large number of minute isolated granules of similar appearance extend throughout the spleen substance. This is probably broken-down blood pigment and is an invariable accompaniment of any disease in which such extensive destruction of red blood-cells takes place as in this. The amount of pigment varies with the rapidity of destruction of blood-cells, and if very great (which only occurs in very acute

cases) it is excreted by the kidney giving rise to the appearance of the urine, which produces the striking symptom of red water. In no instance have we observed such a degree of blood change. In none of the cases has there been even sufficient to cause the thickness of bile, which is one of the characteristic changes in the severe forms of this disease.

(3.) The kidneys show extensive cloudy swelling of their cells, their outlines being quite indistinct, while in a case which had been ailing for weeks the cells appeared quite normal.

(4.) The other organs present, with the exception of anæmia, no morbid pathological change.

Other diseased conditions met with having no relation to Texan fever.

I. Large lumps in the neck. These when opened are found to be chronic, very thick-walled abscesses containing a thin sero-purulent fluid. Cover-glass preparations of the fluid and scrapings from their walls exhibit many micrococci both in bunches and chains and also arranged irregularly throughout the field of the microscope. They are found to stain by Gram's method; and on agar-gelatine exhibit the characteristic growth of the streptococcus pyogenes and the staphylococcus pyogenes aureus.

II. Anthrax.

III. Fluke.

IV. Strongylosis of lungs and stomach in a more acute case are considered in Principal Williams' Report.

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